

COMPLETE MONOGRAPH



2019 GROUP B PUBLIC COMMENT AGENDA

OCTOBER 23 - 30, 2019
RIO HOTEL AND CONVENTION CENTER
LAS VEGAS, NV

2019 Public Comment Agenda

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by

International Code Council, Inc.

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INTRODUCTION

This publication contains the Public Comment Agenda for consideration at the Public Comment Hearings of the International Code Council on October 23 – 30 at the Rio Hotel and Convention Center, Las Vegas (see page 1). See page xl for the hearing schedule.

This publication contains information necessary for consideration of public comments on the proposed code changes which have been considered at the ICC Committee Action Hearings held on April 28 – May 8, 2019, at the Albuquerque Convention Center in Albuquerque, NM. More specifically, this agenda addresses hearings on public comments on proposed code changes to the Administrative Provisions, *International Building Code (Structural)*, *International Energy Conservation Code (Commercial and Residential)*, *International Existing Building Code*, *International Green Construction Code (Chapter 1)*, and *International Residential Code (Building)*.

ICC GOVERNMENTAL MEMBER REPRESENTATIVES

Council Policy #28, Code Development (page xi) requires that applications for Governmental Membership must have been received by March 29 of this year in order for the representatives of the Governmental Member to be eligible to vote at this Public Comment Hearing and the Online Governmental Consensus Vote, which occurs approximately two weeks after the hearings. Further, *CP#28* requires that ICC Governmental Member Representatives reflect the eligible voters **30 days prior** to the start of the Public Comment Hearings. This includes new, as well as changes, to voting status. Sections 9.1 and 9.2 of *CP#28* (page xxxv) read as follows:

- 9.1 Eligible Final Action Voters:** Eligible Final Action voters include ICC Governmental Member Voting Representatives and Honorary Members in good standing who have been confirmed by ICC in accordance with the Electronic Voter Validation System. Such confirmations are required to be revalidated once each code development cycle. After initial validation, changes to the list of GMVRs for the remainder of the code development cycle shall be made in accordance with Section 9.2. Eligible Final Action voters in attendance at the Public Comment Hearing and those participating in the Online Governmental Consensus Vote shall have one vote per eligible voter on all Codes. Individuals who represent more than one Governmental Member shall be limited to a single vote.
- 9.2 Applications:** Applications for Governmental Membership must be received by the ICC at least 30 days prior to the Committee Action Hearing in order for its designated representatives to be eligible to vote at the Public Comment Hearing or Online Governmental Consensus Vote. Applications, whether new or updated, for Governmental Member Voting Representative status must be received by the Code Council 30 days prior to the commencement of the first day of the Public Comment Hearing in order for any designated representative to be eligible to vote. An individual designated as a Governmental Member Voting Representative shall provide sufficient information to establish eligibility as defined in the ICC Bylaws. The Executive Committee of the ICC Board, in its discretion, shall have the authority to address questions related to eligibility.

As such, new and updated eligible voter status must be received by ICC's Member Services Department **by September 23, 2019**. This applies to both voting at the Public Comment Hearings as well as the Online Governmental Consensus Vote which occurs approximately two weeks after the hearings. This must be done via the Electronic Voter Designation System. Access the Electronic Voter Designation System directly by logging on to www.iccsafe.org/EVDS and sing the email address and password connected to your Primary Representative account. The online form can also be accessed by logging onto "My ICC" and selecting "Designate Voters" or through the Electronic Voter Designation link in the left hand menu on the ICC home page at www.iccsafe.org. These records will be used to verify eligible voter status for the Public Comment Hearing and the Online Governmental Consensus Vote. Voting members are strongly encouraged to review their membership record for accuracy so that any necessary changes are made prior to the September 23 deadline. **Representatives of any Governmental Member that has made application for membership after March 29, 2019 will not be able to vote.**

ICC POLICY ON FINANCIAL ASSISTANCE FOR GOVERNMENTAL MEMBER VOTING REPRESENTATIVES

ICC Council Policy 36 Financial Assistance defines the circumstances under which it is permissible for Governmental Member Voting Representatives to accept funds to enable a Governmental Member Voting Representative to attend ICC code hearings. The policy seeks to prohibit, or appropriately regulate financial assistance which is designed to increase Participation by a Particular interest group or by those supporting a Particular position on a proposed code change.

As part of the registration process (see below), eligible voting members are required to verify their voting status in order to receive a voting device. Improper acceptance of financial assistance, or misrepresentation by a Governmental Member Voting Representative about compliance with CP 36, which are discovered after a code hearing, may result in sanctions regarding voting at future hearings by the Governmental Member Voting Representative or by other Governmental Member Voting Representatives from the same governmental member. CP 36 provides, in pertinent Part:

- 2.0. Contributions.** To allow industry and the public to contribute to the goals of the ICC in transparent and accountable processes, organizations and individuals are permitted to contribute financial assistance to Governmental Members to further ICC Code Development Activities provided that:
 - 2.1** Contributions of financial assistance to Governmental Member Voting Representatives for the purposes of enabling participation in ICC Code Development Activities are prohibited except for reimbursements by the ICC or its subsidiaries, a regional, state, or local chapter of the ICC, or the local, state or federal unit of government such Governmental Member Voting Representative is representing. For the purposes of this policy financial assistance includes the payment of expenses on behalf of the Governmental Member or Governmental Member Voting Representative. Governmental Member Voting Representatives may self-fund for purposes of participating in ICC Activities.
 - 2.2** A Governmental Member accepting contributions of financial assistance from industry or other economic interests shall do so by action of its elected governing body or chief administrative authority. A Governmental Member Voting Representative may not directly accept financial assistance from industry or other economic interests.
 - 2.3** Any contributions to a Governmental Member of the ICC shall comply with applicable law, including but not limited to a Governmental Member's ethics, conflict of interest or other similar rules and regulations.

ADVANCE REGISTRATION

The Public Comment Hearings are only one component of the 2019 ICC Annual Conference and Group B Public Comment Hearings. **All attendees to the Public Comment Hearings are required to register. Registration for the Public Comment Hearings is FREE, and is necessary to verify voting status (see above). You are encouraged to register prior to the Public Comment Hearings. To register for the full Conference, the Education Program, or the Public Comment Hearings, go to http://media.iccsafe.org/2019_ICC_AnCon/register.html.**

NOTICE: If you or your companion require special accommodations to participate fully, please advise ICC of your needs.

ANTITRUST COMPLIANCE

ICC brings together numerous government officials and industry members to participate in the code and standard development process. ICC provides basic guidance on the antitrust laws that may be applicable to these and other activities sponsored by ICC ("ICC Activities"). [Click here](#) to view ICC's policy on Antitrust Compliance.

AGENDA FORMAT

This Public Comment Hearing Agenda includes the Consent Agenda and the Individual Consideration Agenda for the code change proposals that comprise the 2019 Code Development Cycle. This will complete the Public Comment Hearings for the 2019 Code Development Cycle.

The Consent Agenda is comprised of proposed changes to the Administrative Provisions, *International Building Code (Structural)*, *International Energy Conservation Code (Commercial and Residential)*, *International Existing Building Code*, *International Green Construction Code (Chapter 1)*, and *International Residential Code (Building)*, which did not receive a successful assembly action or public comment, and therefore are not listed on the Individual Consideration Agenda.

The Individual Consideration Agenda is comprised of proposed changes, *which* either received a successful assembly action or received a public comment in response to the Code Committee's action at the Committee Action Hearings.

Items on the Individual Consideration Agenda are published with information as originally published for the Committee Action Hearing as well as the published hearing results. Following the hearing results is the reason that the item is on the Individual Consideration Agenda followed by the public comments, which were received.

Public testimony will follow the procedures given in *CP#28-05 Code Development* as published on page x. Refer to the tentative hearing order on page xxxix.

MODIFICATIONS & PUBLIC COMMENTS

In addition to modifications made by a committee at the Committee Action Hearings, *CP#28 Code Development* allows successful modifications, which were voted on during the Online Assembly Vote following the Committee Action Hearings. In addition, modifications can be proposed in form of a Public Comment following the Committee Action Hearings. The Public Comment deadline was July 24, 2019 and all Public Comments received have been incorporated into this document. **Further modifications are not permitted beyond those published in this agenda.**

Proposed changes on the Individual Consideration Agenda at the Public Comment Hearings may have up to five possible motions - Approval as Submitted, Approval as Modified by the Code Committee, Approval as Modified by a successful Assembly Action, Approval as Modified by a Public Comment, or Disapproval. A Public Comment Hearings Discussion Guide will be [posted](#) and copies available at the hearing which includes a list of allowable motions for each code change proposal.

CONSENT AGENDA

The Public Comment Consent Agenda consists of proposals, which received neither a successful assembly action nor a public comment. The Public Comment Consent Agenda for each code will be placed before the assembly at the beginning of each code with a motion and vote to ratify final action in accordance with the results of the Committee Action Hearing.

INDIVIDUAL CONSIDERATION AGENDA

The Public Comment Hearing Individual Consideration Agenda is comprised of proposals, which have a successful assembly action or public comment. For each code, the proposed changes on the Individual Consideration Agenda shall be placed before the assembly for individual consideration of each item. The hearing order is found on page xxlii and the agenda starts on page 1.

ICC PUBLIC COMMENT HEARING PROCESS

The hearing process will follow CP #28. The process is summarized as follows and will occur for each code noted in the hearing order (CP #28 sections noted):

1. At the start of each of the individual hearings for the respective code (see page xxxix):
 - Requests to withdraw code changes
 - Requests to withdraw public comments
 - Requests to revise the hearing order
 - Consent Agenda voted (Section 7.5.5)
2. The first code change on the hearing order brought to the floor with a standing motion to sustain the committee action.
3. If the Committee Action is not Disapproval, a motion to approve a modification by a public comment may be presented (Section 7.5.9.6).
4. Public testimony on either the Committee Action (if Disapproval) or the public comment (Section 5.5.1)
5. ICC Governmental Member Representatives and Honorary Members (“eligible voters”) in attendance vote on the motion under consideration. (See page i)
6. Depending on the motion and action determined by the vote, subsequent allowable motions in accordance with Sections 7.5.9.8 can be considered or voting on the main motion in accordance with 7.5.9.7 is taken. (A Public Comment Hearing Discussion Guide will be posted and copies available at the hearing, which includes a listing of allowable motions.)
7. The public comment hearing result on the code change determined by a vote of the eligible voters is announced. In accordance with Section 7.5.7, reconsideration is not permitted. This result will be placed on the Online Governmental Consensus Vote (Section 8.0), which will be open approximately two weeks after the hearings are complete (see page v).
8. Repeat 2 – 7 for subsequent code changes
9. Go the next code indicated on the hearing order and repeat 1 – 8.

ELECTRONIC VOTING PUBLIC COMMENT HEARING FOLLOWED BY ONLINE GOVERNMENTAL CONSENSUS VOTE

The public comment hearing is the first step in the process to arrive at Final Action on code changes – Public Comment Hearing (PCH) voting followed by the Online Governmental Consensus Vote (OGCV) utilizing cdpACCESS®. Be sure to review the deadlines and eligible voter information on page i. The sections noted below are the applicable sections of CP #28 which is published on page x.

In accordance with Section 7.5.9.7 electronic voting will be used for voting at the PCH. Electronic voting devices will be available for all eligible voters and can be picked up at a designated area at the entrance to the hearing rooms after registration. Voting devices are to be returned to this designated area at the end of each day and picked up each morning. Therefore, you may want to allow extra time in the mornings to pick up your voting device before the hearings begin.

Public Comment Hearing Vote

The first step is the voting that will occur at the Public Comment Hearing. This process is regulated by Section 7.5.9 of CP #28.

The Consent Agenda will be voted with a motion to ratify the action taken at the Committee Action Hearings. This will be the Final Action on those code changes, and they will not be considered in the Online Governmental Consensus Vote (Section 7.5.5).

As part of the Individual Consideration Agenda, individual motions for modifications to the main motion will be dealt with by a hand vote followed by the electronic vote if the moderator cannot determine the outcome of the hand vote. However, in accordance with Section 7.5.9.7, the vote on the main motion to determine the PCH action must be taken electronically with the vote recorded since this is necessary for the second step in the process (see below). As noted in Section 7.5.9.8, if the motion is not successful, motions for Approval as Submitted or Approval as Modified are in order. A motion for Disapproval is not in order. The voting majorities have not changed and are indicated in Section 7.6. As in the past, if the code change proposal does not receive any of the required majorities in accordance with Section 7.6, Section 7.5.9.9 stipulates that the PCH action will be Disapproval. However, the vote recorded will be the vote count on the main motion in accordance with Section 7.5.9.7.

Online Governmental Consensus Vote

The second step in the final action process is the Online Governmental Consensus Vote (OGCV). This process was first used in the 2014 Cycle, and is built into cdpACCESS and is regulated by Section 8.0. It is anticipated that the ballot period will start approximately two weeks after the Public Comment Hearings and will be open for two weeks.

The results of the PCH set the agenda and ballot options for the OGCV. This is stipulated in Section 8.1. For example, if the action taken at the PCH is AMPC 1, 3, 7 (Approved as Modified by Public Comments 1,3 and 7) then the OGCV ballot will be structured to allow eligible voters to vote for either AMPC 1,3, 7 or Disapproval in accordance with the table. The voting majority required for AMPC 1, 3, 7 at the PCH was a 2/3 majority which is the same majority that applies to the OGCV. The vote tally from the PCH will be combined with the vote tally from the OGCV to determine the Final Action. In the example cited, the

combined vote tally would be required to meet the 2/3 majority in order for the final action to be AMPC 1, 3, 7. If the voting majority is less than the 2/3 required, Section 10.3 stipulates the Final Action to be Disapproval.

Be sure to review Section 8.2 which identifies the composition of the ballot. Of note is item 4 where the PCH action is Approved as Modified. The resulting text will be presented in the ballot with the modification(s) incorporated into the original code change in order for the voter to see how the text would appear in the code. A key part of this ballot is also item 10 where the voter will have access to the hearing video from both hearings.

Non-eligible voters will also be able to login and view the OGCV ballot, but will not be permitted to vote.

Eligible voting members who voted at the Public Comment Hearings are not required to vote on the OGCV. The vote entered on the electronic voting device at the PCH will automatically be tabulated on the OGCV.

Final Action on Proposed Code Changes

Section 10.0 regulates the tabulation, certification and posting of the final action results. In accordance with Section 10.4, the Final Action will be published as soon as practicable and will include the action and vote counts from both the PCH and OGCV.

VIEW THE PUBLIC COMMENT HEARINGS ON YOUR PC

The Public Comment Hearings are scheduled to be “webcast”. Streaming video broadcast over the Internet will provide a gateway for all International Code Council members, the construction industry and other interested parties anywhere in the world to view and listen to the hearings. Logging on to the Internet broadcast will be as simple as going to the International Code Council web site, www.iccsafe.org and clicking on a link. [Actual site to be determined - be sure to check the ICC web site for further details].

The hearings can be seen at no cost by anyone with Internet access. Minimum specifications for viewing the hearings are an Internet connection, sound card and Microsoft Windows Media Player. DSL, ISDN, Cable Modems or other leased-line connections are recommended for the best viewing experience. A dial-up modem connection will work, but with reduced video performance.

The 2018 cycle included a new hearing video feature – all hearing videos are now posted following the hearings at <http://hearingvideos.iccsafe.org/>.

PUBLIC COMMENT HEARING CONSIDERATION OF ADM 47-19

As indicated below, Section 4.6 of CP28 notes that updates to referenced standards are accomplished administratively through consideration of a code change proposal. Section 4.6 allows multiple referenced standards updates in a single proposal for ease of processing and placing all the updates together. In this 2019 cycle, the code change proposal for updating referenced standards is ADM47-19.

4.6 Updating Standards Referenced in the Codes: Standards referenced by the Codes that do not require coordination with a code change proposal to the code text shall be updated administratively by the Administrative Code Development Committee in accordance with these full procedures except that

the deadline for availability of the updated standard and receipt by the Secretariat shall be December 1 of the third year of each code cycle. The published version of the new edition of the Code which references the standard will refer to the updated edition of the standard. If the standard is not available by the December 1st deadline, the edition of the standard as referenced by the newly published Code shall revert back to the reference contained in the previous edition and an errata to the Code issued. Multiple standards to be updated may be included in a single proposal.

Multiple standards to be updated may be included in a single proposal. Each referenced standard listed in ADM47-19 is essentially a separate code change proposal or part. Action taken on each referenced standard is independent of action taken on other 2019 ICC PUBLIC COMMENT AGENDA vii standards. All totaled, there are over 950 referenced standards being considered for update and 9 of the referenced standards proposed to be updated have received a public comment requesting either Approval As Submitted (AS), Approval As Modified by Public Comment (AMPC) or Disapproval (D). Therefore, ADM47-19 will be dealt with procedurally by dividing the question as a multiple part code change proposal; with each referenced standard receiving a public comment being dealt with as a separate part in conjunction with the submitted public comment. Updates to the referenced standards listed in ADM47-19 that did not receive a public comment will be processed as part of the Consent Agenda in accordance with Section 7.4.

PROPONENT REVIEW OF PUBLIC COMMENTS

While great care has been exercised in the publication of this document, there may be errata posted for the Public Comment Agenda. **As indicated in the cdpACCESS automated response to public comment proposals, public comment proponents are encouraged to carefully review their comments and email errata to dbroadnax@iccsafe.org by September 18, 2019 to be included in our published errata to the Public Comment Hearing Agenda in order to be included in the agenda for consideration at the Public Comment Hearings.** Errata, if any, identified prior to the Public Comment Hearings will be posted as updates to the Public Comment Hearing Agenda on the ICC website at <https://www.iccsafe.org/products-and-services/i-codes/code-development/current-code-development-cycle/>. Users are encouraged to periodically review the ICC Website for updates to the 2019 Public Comment Hearing Agenda.

EDITORIAL CODE CHANGES - CODE CORRELATION COMMITTEE

In a typical code change cycle, there are code change proposals that are considered strictly editorial. Section 4.4 of CP 28 (see below) establishes a process by which the Code Correlation Committee (CCC) considers such proposals.

4.4 Editorial Code Change Proposals. When a code change proposal is submitted that proposes an editorial or format change that, in the opinion of the Secretariat, does not affect the scope or application of the code, the proposal shall be submitted to the Code Correlation Committee who shall deem the code change proposal as editorial or send the proposal back to the Secretariat to be considered by the appropriate code development committee. To be deemed editorial, such proposal shall require a majority vote of the Code Correlation Committee. Editorial proposals shall be published in the Code Change Agenda. Such proposals shall be added to the hearing agenda for consideration by the appropriate code development committee upon written request to ICC by any individual. The deadline to submit such requests shall be 14 days prior to the first day of the Committee Action Hearing. Code Correlation Committee proposals that are not added to a code development committee hearing agenda

shall be published in the next edition of the code with no further consideration.

Since a public comment, by extension, is part of a code change proposal, ICC has applied the purpose and intent of Section 4.4 to public comments. There is one such public comment in the current 2019 Cycle. The comment is located after the last code change in the PCH Agenda and is identified by a code change prefix of CCC. As noted in Section 4.4, anyone may request that this proposals (public comment) be added to the hearing agenda, in this case for individual consideration.

The deadline to make such a request is 11: 59 pm Pacific on Tuesday, October 8, 2019 via email. Be sure to identify the code change number noted above. Such requests must be sent to:
Ed Wirtschoreck Director, Codes ewirtschoreck@iccsafe.org

2018/2019 ICC CODE DEVELOPMENT SCHEDULE

(February 10, 2017)

STEP IN CODE DEVELOPMENT CYCLE	DATE	
	2018 – Group A Codes IBC- E, IBC - FS, IBC -G, IFC, IFGC, IMC, IPC, IPMC, IPSDC, IRC – M, IRC- P, ISPSC, IWUIC, IZC	2019 – Group B Codes Admin, IBC-S, IEBC, IECC-C, IECC- R/IRC-E, IgCC (Ch. 1), IRC – B
2018 EDITION OF I-CODES PUBLISHED	Fall/2017 (except 2018 IgCC, see Group B Codes on next page)	
DEADLINE FOR RECEIPT OF APPLICATIONS FOR ALL CODE COMMITTEES	June 1, 2017 for the 2018/2019 Cycle. Call for committee posted in February /2017.	
DEADLINE FOR cdpACCESS ONLINE RECEIPT OF CODE CHANGE PROPOSALS	January 8, 2018	January 7, 2019
WEB POSTING OF “PROPOSED CHANGES TO THE I-CODES”	February 28, 2018*	March 4, 2019*
COMMITTEE ACTION HEARING (CAH)	April 15 – 23, 2018 Greater Columbus Convention Center Columbus, OH	April 28 – May 8, 2019 Albuquerque Convention Center Albuquerque, NM
ONLINE CAH ASSEMBLY FLOOR MOTION VOTE	Starts approx. two weeks after last day of the CAH. Open for 2 weeks.	Starts approx. two weeks after last day of the CAH. Open for 2 weeks.
WEB POSTING OF “REPORT OF THE COMMITTEE ACTION HEARING”	May 30, 2018	June 11, 2019
DEADLINE FOR cdpACCESS ONLINE RECEIPT OF PUBLIC COMMENTS	July 16, 2018	July 24, 2019
WEB POSTING OF “PUBLIC COMMENT AGENDA”	August 31, 2018*	September 4, 2019*
PUBLIC COMMENT HEARING (PCH) ANNUAL CONFERENCE DATES NOTED BY AC	October 24 – 31, 2018 Greater Richmond Convention Center Richmond, VA AC: October 21 – 23	October 23 – 30, 2019 Clark County, NV AC: October 20 - 22
ONLINE GOVERNMENTAL CONSENSUS VOTE (OGCV)	Starts approx. two weeks after last day of the PCH. Open for 2 weeks.	Starts approx. two weeks after last day of the PCH. Open for 2 weeks.
WEB POSTING OF FINAL ACTION	Following Validation Committee certification of OGCV and ICC Board confirmation.	Following Validation Committee certification of OGCV and ICC Board confirmation.

* Web posting of the “Proposed Changes to the I-Codes” and “Public Comment Agenda” will be posted no later than scheduled. ICC will make every effort to post these documents earlier, subject to code change/public comment volume and processing time.

2018 Group A Codes/Code committees:

- IBC-E: IBC Egress provisions. Chapters 10 and 11.
- IBC-FS: IBC Fire Safety provisions. Chapters 7, 8, 9 (partial), 14 and 26. Majority of IBC Chapter 9 is maintained by the IFC. See notes.
- IBC-G: IBC General provisions. Chapters 3 – 6, 12, 13, 27 – 33.
- IFC: The majority of IFC Chapter 10 is maintained by IBC-E. See notes.
- IFGC
- IMC
- IPC
- IPMC (code changes heard by the IPM/ZC (IPMC & IZC) code committee)
- IPSDC (code changes heard by the IPC code committee)
- IRC-M: IRC Mechanical provisions. Chapters 12 – 23 (code changes heard by the IRC - MP code committee)
- IRC-P: IRC Plumbing provisions. Chapters 25 – 33 (code changes heard by the IRC - MP code committee)
- ISPSC
- IWUIC (code changes heard by the IFC code committee)
- IZC (code changes heard by the IPM/ZC (IPMC & IZC) code committee)

2019 Group B Codes/Code committees:

- Admin: Chapter 1 of all the I-Codes except the IECC, IgCC and IRC. Also includes the update of currently referenced standards in all of the 2018 Codes, except the IgCC.
- IBC-S: IBC Structural provisions. IBC Chapters 15 – 25 and IEBC structural provisions. See notes.
- IEBC: IEBC Non-structural provisions. See notes.
- IECC-C: IECC Commercial energy provisions.
- IECC-R/IRC-E: IECC Residential energy provisions and IRC Energy provisions in Chapter 11.
- IgCC: Chapter 1 of the IgCC. Remainder of the code is based on the provisions of ASHRAE Standard 189.1 *Standard for the Design of High-Performance Green Buildings, Except Low-Rise Residential Buildings*. The 2018 IgCC is scheduled to be published in the Summer/2018.
- IRC-B: IRC Building provisions. Chapters 1 – 10.

A 2020 Group C cycle is not scheduled.

Notes:

- Be sure to review the document entitled “2018/2019 Code Committee Responsibilities” which will be posted. This identifies responsibilities, which are different than Group A and B codes and committees which may impact the applicable code change cycle and resulting code change deadline. As an example, throughout Chapter 14 of the IBC (IBC – Fire Safety), there are numerous sections which include the designation “[BS]” which indicates that the provisions of the section are maintained by the IBC – Structural code committee. Similarly, there are several sections in Chapter 3 of the IMC, which include the designation “[BS]”. These are structural provisions, which will be heard by the IBC – Structural committee. The designations in the code are identified in the Code Committee Responsibilities document.
- I-Code Chapter 1: Proposed changes to the provisions in Chapter 1 of the majority of the I-Codes are heard in Group B (see Admin above for exceptions). Be sure to review the brackets ([]) of the applicable code.
- Definitions. Be sure to review the brackets ([]) in Chapter 2 of the applicable code and the Code Committee Responsibilities document to determine which code committee will consider proposed changes to the definitions.
- Proposed changes to the ICC Performance Code will be heard by the code committee noted in brackets ([]) in the section of the code and in the Code Committee Responsibilities document

2018 - 2019 STAFF SECRETARIES

GROUP A (2018)

IBC – Egress Chapters 10, 11	IBC – Fire Safety Chapters 7, 8, 9, 14, 26	IBC – General Chapters 1-6, 12, 13, 27- 34	IFC	IFGC
Kim Paarlberg Indianapolis, IN Ext 4306 kpaarlberg@iccsafe.org	Michelle Britt Chicago Regional Office Ext 4284 mbritt@iccsafe.org Kermit Robinson Western Regional Office Ext 3317 krobinson@iccsafe.org	Kermit Robinson Western Regional Office Ext 3317 krobinson@iccsafe.org Allan Bilka Central Regional Office Ext 4326 abilka@iccsafe.org	Beth Tubbs Northbridge, MA Ext 7708 btubbs@iccsafe.org Keith Enstrom Chicago Regional Office Ext 4342 kenstrom@iccsafe.org	Gregg Gress Chicago Regional Office Ext 4343 ggress@iccsafe.org
IMC	IPC/IPSDC	ICC Performance (All provisions except Structural [BS] and Commercial Energy [CE])	IPMC	IRC Mechanical
Gregg Gress Chicago Regional Office Ext 4343 ggress@iccsafe.org	Fred Grable Chicago Regional Office Ext 4359 fgrable@iccsafe.org	Beth Tubbs Northbridge, MA Ext 7708 btubbs@iccsafe.org	Ed Wirtschoreck Chicago Regional Office Ext 4317 ewirtschoreck@iccsafe.org	Gregg Gress Chicago Regional Office Ext 4343 ggress@iccsafe.org
IRC Plumbing	ISPSC	IWUIC	IZC	
Fred Grable Chicago Regional Office Ext 4359 fgrable@iccsafe.org	Fred Grable Chicago Regional Office Ext 4359 fgrable@iccsafe.org	Keith Enstrom Chicago Regional Office Ext 4342 kenstrom@iccsafe.org	Ed Wirtschoreck Chicago Regional Office Ext 4317 ewirtschoreck@iccsafe.org	

GROUP B (2019)

ADMINISTRATIVE Chapter 1 All Codes (Except IECC, IgCC & IRC)	IBC-Structural Chapters 15-25 IEBC Structural	IECC-Commercial Commercial Chapters C1- C5	IECC/IRC – Residential IECC Residential Chapters R1 – R5, IRC Chapter 11	IEBC
Kim Paarlberg Indianapolis, IN Ext 4306 kpaarlberg@iccsafe.org	Lawrence Novak Chicago Regional Office Ext 4405 lnovak@iccsafe.org Ed Wirtschoreck Chicago Regional Office Ext 4317 ewirtschoreck@iccsafe.org	Michelle Britt Chicago Regional Office Ext 4284 mbritt@iccsafe.org	Michelle Britt Chicago Regional Office Ext 4287 mbritt@iccsafe.org	Beth Tubbs Northbridge, MA Ext 7708 btubbs@iccsafe.org Keith Enstrom Chicago Regional Office Ext 4342 kenstrom@iccsafe.org
ICC Performance (Structural [BS] and Commercial Energy [CE])	IgCC (Chapter 1 Only)	IRC-Building		
Beth Tubbs Northbridge, MA Ext 7708 btubbs@iccsafe.org	Allan Bilka Central Regional Office Ext 4326 abilka@iccsafe.org	Allan Bilka Central Regional Office Ext 4326 abilka@iccsafe.org Kim Paarlberg Indianapolis, IN Ext 4306 kpaarlberg@iccsafe.org		



CP #28-05 CODE DEVELOPMENT

Approved: 9/24/05

Revised: 1/22/19

1.0 Introduction

- 1.1 **Purpose of Council Policy:** The purpose of this Council Policy is to prescribe the Rules of Procedure utilized in the continued development and maintenance of the International Codes (Codes).
- 1.2 **Objectives:** The ICC Code Development Process has the following objectives:
 - 1.2.1 The timely evaluation and recognition of technological developments pertaining to construction regulations.
 - 1.2.2 The open discussion of code change proposals by all parties desiring to participate.
 - 1.2.3 The final determination of Code text by public officials actively engaged in the administration, formulation or enforcement of laws, ordinances, rules or regulations relating to the public health, safety and welfare and by honorary members.
 - 1.2.4 The increased participation of all parties desiring to participate through an online submittal and voting process that includes opportunities for online collaboration.
- 1.3 **Code Publication:** The ICC Board of Directors (ICC Board) shall determine the title and the general purpose and scope of each Code published by the ICC.
 - 1.3.1 **Code Correlation:** The provisions of all Codes shall be consistent with one another so that conflicts between the Codes do not occur. A Code Scoping Coordination Matrix shall determine which Code shall be the primary document, and therefore which code development committee shall be responsible for maintenance of the code text where a given subject matter or code text could appear in more than one Code. The Code Scoping Coordination Matrix shall be administered by the Code Correlation Committee as approved by the ICC Board. Duplication of content or text between Codes shall be limited to the minimum extent necessary for practical usability of the Codes, as determined in accordance with Section 4.5.
- 1.4 **Process Maintenance:** The review and maintenance of the Code Development Process and these Rules of Procedure shall be by the ICC Board. The manner in which Codes are developed embodies core principles of the organization. One of those principles is that the final content of the Codes

is determined by a majority vote of the governmental and honorary members. It is the policy of the ICC Board that there shall be no change to this principle without the affirmation of two-thirds of the governmental and honorary members responding.

- 1.5 Secretariat:** The Chief Executive Officer shall assign a Secretariat for each of the Codes. All correspondence relating to code change proposals and public comments shall be addressed to the Secretariat. The Secretariat shall have the authority to facilitate unforeseen situations which arise in the implementation of this council policy. Staff shall maintain a record of such actions.
- 1.6 Recording:** Individuals requesting permission to record any meeting or hearing, or portion thereof, shall be required to provide the ICC with a release of responsibility disclaimer and shall acknowledge that ICC shall retain sole ownership of the recording, and that they have insurance coverage for liability and misuse of recording materials. Equipment and the process used to record shall, in the judgment of the ICC Secretariat, be conducted in a manner that is not disruptive to the meeting. The ICC shall not be responsible for equipment, personnel or any other provision necessary to accomplish the recording. An unedited copy of the recording shall be forwarded to ICC within 30 days of the meeting. Recordings shall not otherwise be copied, reproduced or distributed in any manner. Recordings shall be returned to ICC or destroyed upon the request of ICC.

2.0 Code Development Cycle

- 2.1 Intent:** The code development cycle shall consist of the complete consideration of code change proposals in accordance with the procedures herein specified, commencing with the deadline for submission of code change proposals (see Section 3.5) and ending with publication of the Final Action on the code change proposals (see Section 10.4).
- 2.2 New Editions:** The ICC Board shall determine the schedule for publishing new editions of the Codes. Each new edition shall incorporate the results of the code development activity since the previous edition.
- 2.3 Supplements:** The results of code development activity between editions may be published.
- 2.4 Interim Code Amendments:** All revisions to the International Codes shall be processed in accordance with other sections of this Council Policy except for Emergency Actions by the ICC Board complying with Section 2.4.1 and Interim Critical Amendments (ICA) complying with Section 2.4.2.
 - 2.4.1 Emergency Actions by the ICC Board:** Emergency actions by the ICC Board are limited to those issues representing an immediate threat to health and safety that warrant a more timely response than allowed by the Code Development Process schedule.
 - 2.4.1.1 Initial Request:** A request for an emergency action shall be based upon perceived immediate threats to health and safety and shall be reviewed by the Codes and Standards Council for referral to the ICC Board for action with their analysis and recommendation.

2.4.1.2 Board and Member Action: In the event that the ICC Board determines that an emergency amendment to any Code or supplement thereto is warranted, the same may be adopted by the ICC Board. Such action shall require an affirmative vote of at least two-thirds of the ICC Board.

The ICC membership shall be notified within ten days after the ICC Boards' official action of any emergency amendment. At the next Annual Business Meeting, any emergency amendment shall be presented to the members for ratification by a majority of the Governmental Member Voting Representatives and Honorary Members present and voting.

All code revisions pursuant to these emergency procedures and the reasons for such corrective action shall be published as soon as practicable after ICC Board action. Such revisions shall be identified as an emergency amendment.

Emergency amendments to any Code shall not be considered as a retro-active requirement to the Code. Incorporation of the emergency amendment into the adopted Code shall be subjected to the process established by the adopting authority.

2.4.2 Interim Critical Amendments (ICA)

2.4.2.1 Submittal. Anyone may propose an ICA by providing the following information:

- a) Name of submitter
- b) Contact information
- c) Submitters representation
- d) Date
- e) Relevant section(s) and code edition(s) under consideration
- f) Proposed modifications with text changes identified using underlines for new text and strikethroughs for deleted text
- g) A statement that substantiates the need for proposed changes and why the proposed submission is of such a critical nature in accordance with Section 2.4.2.3 that it cannot be left to be addressed during the next code development cycle.
- h) Written endorsement of the proposed ICA by not less than two members of the Code Development Committee(s) responsible for maintaining the affected code section(s)

2.4.2.2 Preliminary Review. An ICA will only be processed if the Codes and Standards Council determines that the proposed ICA appears to be of a critical nature requiring prompt action based on the criteria specified in Section 2.4.2.3. If processed, the question of critical nature shall be further considered by the responsible Code Development Committee(s) and the Codes and Standards Council. The text of a proposed ICA shall be processed as submitted or shall be changed with the approval

of the submitter. The Codes and Standards Council shall process their preliminary “critical nature” determination within 45 days of the ICA submission.

2.4.2.3 Determination of Critical Nature. Qualification for critical nature shall be based on one or more of the following factors:

- a) The proposed ICA corrects an error or an omission that was overlooked during a regular code development process.
- b) The proposed ICA resolves a conflict within an individual code or a conflict involving two or more ICC codes.
- c) The proposed ICA mitigates a previously unknown hazard.

2.4.2.4 Code Development Committee. A proposed ICA that meets the provisions in Sections 2.4.2.2 and 2.4.2.3 shall be submitted to the Code Development Committee(s) responsible for the affected section(s) for a ballot and comment period of 30 calendar days. The committee(s) shall be separately balloted on both the technical merit of the ICA and whether the ICA satisfies the critical nature criteria. Negative votes in the initial ballot, if any, shall require a reason statement and shall be circulated to the full committee(s) to allow initial ballot votes to be changed.

A committee recommendation for approval shall require an affirmative vote of at least three-fourths of members who voted, on both technical merit and critical nature. The following shall be omitted from the three-fourths vote calculation:

- a) Committee members who have abstained.
- b) Committee members whose negative ballots do not include a statement conveying the reason for casting a negative vote.
- c) Committee members who do not return their ballots prior to the announced ballot return deadline.

In addition to the three-fourths majority described above, the number of affirmative votes shall be not less than 50% of all committee members who are eligible to vote. Committee members eligible to vote shall be the total number of individuals who are members of the committee on the date of ballot distribution and shall not be adjusted based on abstentions or ballots that were not returned.

ICAs that achieve the required number of affirmative votes on both technical merit and critical nature are approved for further processing in accordance with Sections 2.4.2.5 through 2.4.2.9. ICAs that do not achieve the required number of affirmative votes on both technical merit and critical nature are rejected.

2.4.2.5 Publication of Proposed ICA for Public Comment. An ICA that is approved in accordance with Section 2.4.2.4 shall be published by ICC in appropriate media with a notice inviting

public comments on the proposed ICA. The public comment period shall be open for at least 30 calendar days from the date of posting of the notice. When a proposed ICA revises text that was changed in the most recent code development cycle, the ICA public comment notice shall also be directly provided to submitters of proposals and public comments to the affected section in the most recent code development cycle.

- 2.4.2.6 Additional Code Development Committee Review.** All public comments shall be circulated to the responsible Code Development Committee(s) for a 30-calendar day ballot and comment period allowing an opportunity for committee members to change votes taken prior to the public comment period. If any votes are changed to negative, negative votes shall be circulated to the full committee, followed by a final ballot following the voting procedures Section 2.4.2.4.

Approved ICAs shall be forwarded to the Codes and Standards Council with a staff report that includes all public comments, ballots, committee member comments on ballots and concurrence by staff on which code editions should be affected by the ICA.

- 2.4.2.7 Action of the Codes and Standards Council.** The Codes and Standards Council shall review the material submitted in accordance with Section 2.4.2.6 at the next Codes and Standards Council meeting. Approval of an ICA shall require an affirmative vote of at least two-thirds of the Codes and Standards Council members who cast a vote at the meeting.

- 2.4.2.8 Effective Date and Publication.** ICAs that are approved by the Codes and Standards Council shall become effective 30 calendar days after approval, or in the case of an appeal in accordance with Section 2.4.2.9, 30 calendar days after a decision by the ICC Board upholding a Codes and Standards Council decision to issue an ICA.

An ICA shall apply to code editions specified by the ICC Codes and Standards Council, and ICC staff shall, by an appropriate method, publish approved ICAs and ensure that approved ICAs are distributed with future sales of affected codes. ICAs shall be distributed as a separate document and shall not be incorporated into the text of a published code until such time that the ICA has been approved by the full code development process, following submittal as a proposal in accordance with Section 2.4.2.11.

- 2.4.2.9 Appeals.** A decision of the Codes and Standards Council to approve an ICA shall be appealable to the ICC Board in accordance with Council Policy 1.

- 2.4.2.10 Applicability.** ICAs shall not be considered retroactive requirements.

2.4.2.11 Subsequent Processing. An approved ICA shall automatically become a code change proposal from the Codes and Standards Council in the following code cycle.

2.5 Code Development Record. The code development record shall include the official documents and records developed in support of the given code development cycle. This includes the following:

1. Code Change Agenda (Section 4.8)
2. Audio and video recording of the Committee Action Hearing (Section 5.1)
3. The Online Assembly Floor Motion Ballot (Section 5.7.3)
4. Report of the Committee Action Hearing (Section 5.8)
5. Public Comment Agenda (Section 6.6)
6. Public Comment Hearing results (Section 7.5.8.10)
7. Audio and video recording of the Public Comment Hearing (Section 7.1)
8. The Online Governmental Consensus Ballot (Section 8.2)
9. Final Action results (Section 10.4)
10. Errata to the documents noted above

The information resulting from online collaboration between interested parties shall not be part of the code development record.

3.0 Submittal of Code Change Proposals

3.1 Intent: Any interested person, persons or group may submit a code change proposal which will be duly considered when in conformance to these Rules of Procedure.

3.2 Withdrawal of Proposal: A code change proposal may be withdrawn by the proponent (WP) at any time prior to membership action on the consent agenda at the Public Comment Hearing or prior to testimony on the code change proposal on the individual consideration agenda at the Public Comment Hearing. All actions on the code change proposal shall cease immediately upon the withdrawal of the code change proposal.

3.3 Form and Content of Code Change Submittals: Each code change proposal shall be submitted separately and shall be complete in itself. Each submittal shall contain the following information:

3.3.1 Proponent: Each code change proposal shall include the name, title, mailing address, telephone number, and email address of the proponent. Email addresses shall be published with the code change proposals unless the proponent otherwise requests on the submittal form.

3.3.1.1 If a group, organization or committee submits a code change proposal, an individual with prime responsibility shall be indicated.

3.3.1.2 If a proponent submits a code change proposal on behalf of a client, group, organization or committee, the name and mailing address of the client, group, organization or committee shall be indicated.

3.3.2 Code Reference: Each code change proposal shall relate to the

applicable code sections(s) in the latest edition of the Code.

3.3.2.1 If more than one section in the Code is affected by a code change proposal, appropriate proposals shall be included for all such affected sections.

3.3.2.2 If more than one Code is affected by a code change proposal, appropriate proposals shall be included for all such affected Codes and appropriate cross referencing shall be included in the supporting information.

3.3.3 Multiple Code Change Proposals to a Code Section. A proponent shall not submit multiple code change proposals to the same code section. When a proponent submits multiple code change proposals to the same section, the proposals shall be considered as incomplete proposals and processed in accordance with Section 4.3. This restriction shall not apply to code change proposals that attempt to address differing subject matter within a code section.

3.3.4 Text Presentation: The text of the code change proposal shall be presented in the specific wording desired with deletions shown struck out with a single line and additions shown underlined with a single line.

3.3.4.1 A charging statement shall indicate the referenced code section(s) and whether the code change proposal is intended to be an addition, a deletion or a revision to existing Code text.

3.3.4.2 Whenever practical, the existing wording of the text shall be preserved with only such deletions and additions as necessary to accomplish the desired change.

3.3.4.3 Each code change proposal shall be in proper code format and terminology.

3.3.4.4 Each code change proposal shall be complete and specific in the text to eliminate unnecessary confusion or misinterpretation.

3.3.4.5 The proposed text shall be in mandatory terms.

3.3.5 Supporting Information: Each code change proposal shall include sufficient supporting information to indicate how the code change proposal is intended to affect the intent and application of the Code.

3.3.5.1 Purpose: The proponent shall clearly state the purpose of the code change proposal (e.g. clarify the Code; revise outdated material; substitute new or revised material for current provisions of the Code; add new requirements to the Code; delete current requirements, etc.)

3.3.5.2 Reasons: The proponent shall justify changing the current Code provisions, stating why the code change proposal is superior to the current provisions of the Code. Code change proposals which add or delete requirements shall be supported by a logical explanation which clearly shows why the current Code provisions are inadequate or overly restrictive, specifies the shortcomings of the current Code provisions and explains how such code change proposals will improve the Code.

3.3.5.3 Substantiation: The proponent shall substantiate the code change proposal based on technical information and substantiation. Substantiation provided which is reviewed in accordance with Section 4.2 and determined as not germane to the technical issues addressed in the code change proposal may be identified as such. The proponent shall be notified that the code change proposal is considered an incomplete proposal in accordance with Section 4.3 and the proposal shall be held until the deficiencies are corrected. The proponent shall have the right to appeal this action in accordance with the policy of the ICC Board. The burden of providing substantiating material lies with the proponent of the code change proposal. Supporting documentation may be provided via a link to a website provided by the proponent and included in the reason statement. The reason statement shall include the date the link was created. All substantiating material published by ICC is material that has been provided by the proponent and in so publishing ICC makes no representations or warranties about its quality or accuracy.

3.3.5.4 Bibliography: The proponent shall submit a bibliography of any substantiating material submitted with the code change proposal. The bibliography shall be published with the code change proposal and the proponent shall make the substantiating materials available for review at the appropriate ICC office and during the public hearing. Supporting documentation may be provided via a link to a website provided by the proponent and included in the bibliography. The reason statement shall include the date the link was created.

3.3.5.5 Copyright Release: The proponent of code change proposals, floor modifications and public comments shall sign a copyright release developed and posted by ICC.

3.3.5.6 Cost Impact: The proponent shall indicate one of the following regarding the cost impact of the code change proposal:

- 1) The code change proposal will increase the cost of construction;
- 2) The code change proposal will decrease the cost of construction; or
- 3) The code change proposal will not increase or decrease the cost of construction.

The proponent shall submit information which substantiates such assertion. This information will be considered by the code development committee and will be included in the published code change proposal. Supporting documentation may be provided via a link to a website provided by the proponent and included in the cost substantiation statement. The cost substantiation statement

shall include the date the link was created.

Any proposal submitted which does not include the requisite cost impact information shall be considered incomplete and shall not be processed.

3.4 Online Submittal: Each code change proposal and all substantiating information shall be submitted online at the website designated by ICC. Two copies of each proposed new referenced standard in hard copy or one copy in electronic form shall be submitted. Additional copies may be requested when determined necessary by the Secretariat to allow such information to be distributed to the code development committee. Where such additional copies are requested, it shall be the responsibility of the proponent to send such copies to the respective code development committee.

3.5 Submittal Deadline: ICC shall establish and post the submittal deadline for each cycle. The posting of the deadline shall occur no later than 120 days prior to the code change deadline. Each code change proposal shall be submitted online at the website designated by ICC by the posted deadline. The submitter of a code change proposal is responsible for the proper and timely receipt of all pertinent materials by the Secretariat.

3.6 Referenced Standards: In order for a standard to be considered for reference or to continue to be referenced by the Codes, a standard shall meet the following criteria:

3.6.1 Code References:

3.6.1.1 The standard, including title and date, and the manner in which it is to be utilized shall be specifically referenced in the Code text.

3.6.1.2 The need for the standard to be referenced shall be established.

3.6.2 Standard Content:

3.6.2.1 A standard or portions of a standard intended to be enforced shall be written in mandatory language.

3.6.2.2 The standard shall be appropriate for the subject covered.

3.6.2.3 All terms shall be defined when they deviate from an ordinarily accepted meaning or a dictionary definition.

3.6.2.4 The scope or application of a standard shall be clearly described.

3.6.2.5 The standard shall not have the effect of requiring proprietary materials.

3.6.2.6 The standard shall not prescribe a proprietary agency for quality control or testing.

3.6.2.7 The test standard shall describe, in detail, preparation of the test sample, sample selection or both.

3.6.2.8 The test standard shall prescribe the reporting format for the test results. The format shall identify the key performance criteria for the element(s) tested.

3.6.2.9 The measure of performance for which the test is conducted shall be clearly defined in either the test standard or in Code text.

- 3.6.2.10 The standard shall not state that its provisions shall govern whenever the referenced standard is in conflict with the requirements of the referencing Code.
- 3.6.2.11 The preface to the standard shall announce that the standard is promulgated according to a consensus procedure.

3.6.3 Standard Promulgation:

- 3.6.3.1 Code change proposals with corresponding changes to the code text which include a reference to a proposed new standard or a proposed update of an existing referenced standard shall comply with this section.

3.6.3.1.1 Proposed New Standards. In order for a new standard to be considered for reference by the Code, such standard shall be submitted in at least a consensus draft form in accordance with Section 3.4. If the proposed new standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding proposed changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the standard is not completed, the code change proposal shall automatically be placed on the Public Comment Agenda with the recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing. If the committee action at the Committee Action Hearing is Disapproval, further consideration on the Public Comment Agenda shall include a recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing.

3.6.3.1.2 Update of Existing Standards. Code change proposals which include technical revisions to the code text to coordinate with a proposed update of an existing referenced standard shall include the submission of the proposed update to the standard in at least a consensus draft form in accordance with Section 3.4. If the proposed update of the existing standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal, including the update of the existing referenced standard, shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the updated standard is not completed, the code change proposal shall automatically be placed on the Public

Comment Agenda with the recommendation stating that in order for the public comment to be considered, the updated standard shall be completed and readily available prior to the Public Comment Hearing. If the committee action at the Committee Action Hearing is Disapproval, further consideration on the Public Comment Agenda shall include a recommendation stating that in order for the public comment to be considered, the updated standard shall be completed and readily available prior to the Public Comment Hearing.

Updating of standards without corresponding code text changes shall be accomplished administratively in accordance with Section 4.6.

3.6.3.2 The standard shall be developed and maintained through a consensus process such as ASTM or ANSI.

4.0 Processing of Code Change Proposals

- 4.1 Intent:** The processing of code change proposals is intended to ensure that each proposal complies with these Rules of Procedure and that the resulting published code change proposal accurately reflects that proponent's intent.
- 4.2 Review:** Upon receipt in the Secretariat's office, the code change proposals will be checked for compliance with these Rules of Procedure as to division, separation, number of copies, form, language, terminology, supporting statements and substantiating data. Where a code change proposal consists of multiple parts which fall under the maintenance responsibilities of different code committees, the Secretariat shall determine the code committee responsible for determining the committee action in accordance with Section 5.6 and the Code Scoping Coordination Matrix (see Section 1.3.1).
- 4.3 Incomplete Code Change Proposals:** When a code change proposal is submitted with incorrect format, without the required information or judged as not in compliance with these Rules of Procedure, the Secretariat shall notify the proponent of the specific deficiencies and the proposal shall be held until the deficiencies are corrected, with a final date set for receipt of a corrected submittal. If the Secretariat receives the corrected code change proposal after the final date, the proposal shall be held over until the next code development cycle. Where there are otherwise no deficiencies addressed by this section, a code change proposal that incorporates a new referenced standard shall be processed with an analysis of the referenced standard's compliance with the criteria set forth in Section 3.6.
- 4.4 Editorial Code Change Proposals.** When a code change proposal is submitted that proposes an editorial or format change that, in the opinion of the Secretariat, does not affect the scope or application of the code, the proposal shall be submitted to the Code Correlation Committee who shall deem the code change proposal as editorial or send the proposal back to the Secretariat to be considered by the appropriate code development committee. To be deemed editorial, such proposal shall require a majority vote of the Code Correlation Committee. Editorial proposals shall be published in the Code Change Agenda. Such proposals shall be added to the hearing agenda for consideration by the appropriate code development committee upon written

request to ICC by any individual. The deadline to submit such requests shall be 14 days prior to the first day of the Committee Action Hearing. Code Correlation Committee proposals that are not added to a code development committee hearing agenda shall be published in the next edition of the code with no further consideration.

4.5 Copy Editing Code Text: The Chief Executive Officer shall have the authority at all times to make editorial style and format changes to the Code text, or any approved changes, consistent with the intent, provisions and style of the Code. Such editorial style or format changes shall not affect the scope or application of the Code requirements.

4.6 Updating Standards Referenced in the Codes: Standards referenced by the Codes that do not require coordination with a code change proposal to the code text shall be updated administratively by the Administrative Code Development Committee in accordance with these full procedures except that the deadline for availability of the updated standard and receipt by the Secretariat shall be December 1 of the third year of each code cycle. The published version of the new edition of the Code which references the standard will refer to the updated edition of the standard. If the standard is not available by the December 1st deadline, the edition of the standard as referenced by the newly published Code shall revert back to the reference contained in the previous edition and an errata to the Code issued. Multiple standards to be updated may be included in a single proposal.

4.6.1 Updating ICC Standards Referenced in the Codes. All standards developed by ICC and referenced by the Codes which are undergoing an update shall be announced by ICC to allow stakeholders to participate in the update process. Where the updated standard is completed and available by December 1 of the third year of the code cycle, the published version of the new edition of the Code which references the standard shall refer to the updated edition of the standard. If the standard is not available by the December 1st deadline, the edition of the standard as referenced by the newly published Code shall revert back to the reference contained in the previous edition and an errata to the Code issued.

4.7 Preparation: All code change proposals in compliance with these procedures shall be prepared in a standard manner by the Secretariat and be assigned separate, distinct and consecutive numbers. The Secretariat shall coordinate related proposals submitted in accordance with Section 3.3.2 to facilitate the hearing process.

4.8 Code Change Agenda: All code change proposals shall be posted on the ICC website at least 30 days prior to the Committee Action Hearing on those proposals and shall constitute the agenda for the Committee Action Hearing. Any errata to the Code Change Agenda shall be posted on the ICC website as soon as possible. Code change proposals which have not been published in the original posting or subsequent errata shall not be considered.

5.0 Committee Action Hearing

5.1 Intent: The intent of the Committee Action Hearing is to permit interested parties to present their views including the cost and benefits on the code

change proposals on the published agenda. The code development committee will consider such comments as may be presented in the development of their action on the disposition of such code change proposals. At the conclusion of the code development committee deliberations, the committee action on each code change proposal shall be placed before the hearing assembly for consideration in accordance with Section 5.7.

5.2 Committee: The Codes and Standards Council shall review all applications and make committee appointment recommendations to the ICC Board. The Code Development Committees shall be appointed by the ICC Board.

5.2.1 Chairman/Moderator: The Chairman and Vice-Chairman shall be appointed by the Codes and Standards Council from the appointed members of the committee. The ICC President shall appoint one or more Moderators who shall act as presiding officer for the Committee Action_Hearing.

5.2.2 Conflict of Interest: A committee member shall withdraw from and take no part in those matters with which the committee member has an undisclosed financial, business or property interest. The committee member shall not participate in any committee discussion or any committee vote on the matter in which they have an undisclosed interest. A committee member who is a proponent of a code change proposal shall not participate in any committee discussion on the matter or any committee vote. Such committee member shall be permitted to participate in the floor discussion in accordance with Section 5.5 by stepping down from the dais.

5.2.3 Representation of Interest: Committee members shall not represent themselves as official or unofficial representatives of the ICC except at regularly convened meetings of the committee.

5.2.4 Committee Composition: The committee may consist of representation from multiple interests. A minimum of thirty-three and one-third percent (33.3%) of the committee members shall be regulators.

5.3 Date and Location: The date and location of the Committee Action Hearing shall be announced not less than 60 days prior to the date of the hearing.

5.4 General Procedures: *The Robert's Rules of Order* shall be the formal procedure for the conduct of the Committee Action Hearing except as a specific provision of these Rules of Procedure may otherwise dictate. A quorum shall consist of a majority of the voting members of the committee.

5.4.1 Chair Voting: The Chairman of the committee shall vote only when the vote cast will break a tie vote of the committee.

5.4.2 Open Hearing: The Committee Action Hearing is an open hearing. Any interested person may attend and participate in the floor discussion and assembly consideration portions of the hearing. Only code development committee members may participate in the committee action portion of the hearings (see Section 5.6). Participants shall not advocate a position on specific code change proposals with committee members other than through the methods provided in this policy.

5.4.3 Presentation of Material at the Public Hearing: Information to be provided at the hearing shall be limited to verbal presentations and modifications submitted in accordance with Section 5.5.2. Each individual presenting information at the hearing shall state their name and affiliation, and shall identify any entities or individuals they are representing in connection with their testimony. Audio-visual presentations are not permitted. Substantiating material submitted in accordance with Section 3.3.5.3 and other material submitted in response to a code change proposal shall be located in a designated area in the hearing room and shall not be distributed to the code development committee at the public hearing.

5.4.4 Agenda Order: The Secretariat shall publish a Code Change Agenda for the Committee Action Hearing, placing individual code change proposals in a logical order to facilitate the hearing. Any public hearing attendee may move to revise the agenda order as the first order of business at the public hearing, or at any time during the hearing except while another code change proposal is being discussed. Preference shall be given to grouping like subjects together, and for moving items back to a later position on the agenda as opposed to moving items forward to an earlier position.

5.4.4.1 Proponent Approval: A motion to revise the agenda order is considered in order unless the proponent(s) of the moved code change proposals are in attendance in the hearing room and object to the move. Where such objections are raised, the motion to revise the hearing order shall be ruled out of order by the Moderator. The ruling of the Moderator shall be final and not subject to a point of order in accordance with Section 5.4.8. The motion to change the hearing order is not debatable.

5.4.4.2 Revised Agenda Order Approved: A motion to revise the agenda order is subject to a 2/3 vote of those present.

5.4.5 Tabling: Tabling of code change proposals shall be permitted. The motion to table is considered in order unless the proponent(s) of the tabled code change proposals are in attendance at the hearing and object to the tabling. Where such objections are raised, the motion to table shall be ruled out of order by the Moderator. The ruling of the Moderator shall be final and not subject to a point of order in accordance with Section 5.4.8. The motion to table is not debatable.

The motion to table must identify one of the following as to the location in the agenda when or where the code change proposal(s) will be considered:

1. To a specific date and time within the timeframe of the Code Change Agenda for the code change proposals under consideration, or
2. To a specific location in the Code Change Agenda for the code change proposals under consideration.

5.4.5.1 Tabling approved: A motion to table is subject to a 2/3 vote

of those present.

5.4.5.2 Tabled code change proposals back to the floor: The Moderator shall bring the tabled code change proposal(s) back to the floor at the applicable time/agenda location in accordance with Section 5.4.5 Items 1 or 2. The testimony on the code change proposal shall resume at the point in the process where the tabling occurred.

5.4.6 Reconsideration: There shall be no reconsideration of a code change proposal after it has been voted on by the committee in accordance with Section 5.6.

5.4.7 Time Limits: Time limits shall be established as part of the agenda for testimony on all code change proposals at the beginning of each hearing session. Each person requesting to testify on a code change proposal shall be given equal time. In the interest of time and fairness to all hearing participants, the Moderator shall have limited authority to modify time limitations on debate. The Moderator shall have the authority to adjust time limits as necessary in order to complete the hearing agenda.

5.4.7.1 Time Keeping: Keeping of time for testimony by an individual shall be by an automatic timing device. Remaining time shall be evident to the person testifying. Interruptions during testimony shall not be tolerated. The Moderator shall maintain appropriate decorum during all testimony.

5.4.7.2 Proponent Testimony: The Proponent is permitted to waive an initial statement. The Proponent shall be permitted to have the amount of time that would have been allocated during the initial testimony period plus the amount of time that would be allocated for rebuttal. Where the code change proposal is submitted by multiple proponents, this provision shall permit only one proponent of the joint submittal to be allotted additional time for rebuttal.

5.4.8 Points of Order: Any person participating in the public hearing may challenge a procedural ruling of the Moderator or the Chairman. A majority vote of ICC Members in attendance shall determine the decision.

5.5 Floor Discussion: The Moderator shall place each code change proposal before the hearing for discussion by identifying the proposal and by regulating discussion as follows:

5.5.1 Discussion Order:

1. Proponents. The Moderator shall begin by asking the proponent and then others in support of the code change proposal for their comments.
2. Opponents. After discussion by those in support of a code change proposal, those opposed hereto, if any, shall have the opportunity to

present their views.

3. Rebuttal in support. Proponents shall then have the opportunity to rebut points raised by the opponents.
4. Re-rebuttal in opposition. Opponents shall then have the opportunity to respond to the proponent's rebuttal.

5.5.2 Modifications: Modifications to code change proposals may be suggested from the floor by any person participating in the public hearing. The person proposing the modification, or his/her designee, is deemed to be the proponent of the modification.

5.5.2.1 Submission. All modifications shall be submitted electronically to the ICC Secretariat in a format determined by ICC unless determined by the Chairman to be either editorial or minor in nature. The modification will be forwarded electronically to the members of the code development committee during the hearing and will be projected on the screen in the hearing room.

5.5.2.2 Criteria. The Chairman shall rule proposed modifications in or out of order before they are discussed on the floor. A proposed modification shall be ruled out of order if it:

1. changes the scope of the original code change proposal; or
2. is not readily understood to allow a proper assessment of its impact on the original code change proposal or the Code.

The ruling of the Chairman on whether or not the modification is in or out of order shall be final and is not subject to a point of order in accordance with Section 5.4.8.

5.5.2.3 Testimony. When a modification is offered from the floor and ruled in order by the Chairman, a specific floor discussion on that modification is to commence in accordance with the procedures listed in Section 5.5.1.

5.6 Committee Action: Following the floor discussion of each code change proposal, one of the following motions shall be made and seconded by members of the committee:

1. Approve the code change proposal As Submitted (AS) or
2. Approve the code change proposal As Modified with specific modifications (AM), or
3. Disapprove the code change proposal (D)

Discussion on this motion shall be limited to code development committee members. If a committee member proposes a modification which had not been proposed during floor discussion, the Chairman shall rule on the modification in accordance with Section 5.5.2.2. If a committee member raises a matter of issue, including a proposed modification, which has not been proposed or discussed during the floor discussion, the Moderator shall suspend the committee discussion and shall reopen the floor discussion for

comments on the specific matter or issue. Upon receipt of all comments from the floor, the Moderator shall resume committee discussion.

The code development committee shall vote on each motion with the majority dictating the committee's action. Committee action on each code change proposal shall be completed when one of the motions noted above has been approved. Each committee vote shall be supported by a reason.

The code development committee shall maintain a record of its proceedings including the action on each code change proposal.

5.7 Assembly Consideration: At the conclusion of the committee's action on a code change proposal and before the next code change proposal is called to the floor, the Moderator shall ask for a motion from the public hearing attendees who may object to the committee's action. If a motion in accordance with Section 5.7.1 is not brought forward on the committee's action, the results of the Committee Action Hearing shall be established by the committee's action.

5.7.1 Assembly Floor Motion: Any attendee may raise an objection to the committee's action in which case the attendee will be able to make a motion to:

1. Approve the code change proposal As Submitted from the Floor (ASF), or
2. Approve the code change proposal As Modified from the Floor (AMF) with a specific modification that has been previously offered from the floor and ruled in order by the Chairman during floor discussion (see Section 5.5.2) or has been offered by a member of the Committee and ruled in order by the Chairman during committee discussion (see Section 5.6), or
3. Disapprove the code change proposal from the floor (DF).

5.7.2 Assembly Floor Motion Consideration: On receipt of a second to the floor motion, the Moderator shall accept the motion and the second and notify the attendees that the motion will be considered in an online ballot following the hearing in accordance with Section 5.7.3. No additional testimony shall be permitted.

5.7.3 Online Assembly Floor Motion Ballot: Following the Committee Action Hearing, all assembly floor motions which received a second shall be compiled into an online ballot. The ballot will include:

1. The code change proposal as published.
2. The committee action and reason from the Committee Action Hearing.
3. The floor motion, including modifications which are part of the floor motion.
4. Access to the audio and video of the Committee Action Hearing proceedings.
5. Identification of the ballot period for which the online balloting will be open.

5.7.4 Eligible Online Assembly Motion Voters: All members of ICC shall be eligible to vote on online assembly floor motions. Each member is

entitled to one vote, except that each Governmental Member Voting Representative may vote on behalf of its Governmental Member. Individuals who represent more than one Governmental Member shall be limited to a single vote. Application, whether new or updated, for ICC membership must be received by the Code Council 30 days prior to the first day of the Committee Action Hearing. The ballot period will not be extended beyond the published period except as approved by the ICC Board._

5.7.5 Assembly Action: A successful assembly action shall be a majority vote of the votes cast by eligible voters (see Section 5.7.4). A successful assembly action results in an automatic public comment to be considered at the Public Comment Hearing (see Section 7.4).

5.8 Report of the Committee Action Hearing: The results of the Committee Action Hearing, including committee action and reason, online assembly floor motion vote results and the total vote count for each assembly floor motion shall be posted on the ICC website not less than 60 days prior to the Public Comment Hearing, except as approved by the ICC Board.

6.0 Public Comments

6.1 Intent: The public comment process gives attendees at the Public Comment Hearing an opportunity to consider specific objections to the results of the Committee Action Hearing and more thoughtfully prepare for the discussion for public comment consideration. The public comment process expedites the Public Comment Hearing by limiting the items discussed to the following:

1. Consideration of items for which a public comment has been submitted; and
2. Consideration of items which received a successful assembly action.

6.2 Deadline: The deadline for receipt of a public comment to the results of the Committee Action Hearing shall be announced at the Committee Action Hearing but shall not be less than 30 days subsequent to the availability of the Report of the Committee Action Hearing (see Section 5.8).

6.3 Withdrawal of Public Comment: A public comment may be withdrawn by the public commenter at any time prior to public comment consideration of that comment. A withdrawn public comment shall not be subject to public comment consideration. If the only public comment to a code change proposal is withdrawn by the public commenter prior to the vote on the consent agenda in accordance with Section 7.5.5, the proposal shall be considered as part of the consent agenda. If the only public comment to a code change proposal is withdrawn by the public commenter after the vote on the consent agenda in accordance with Section 7.5.5, the proposal shall continue as part of the individual consideration agenda in accordance with Section 7.5.6, however the public comment shall not be subject to public comment consideration.

6.4 Form and Content of Public Comments: Any interested person, persons, or group may submit a public comment to the results of the Committee Action Hearing which will be considered when in conformance to these requirements. Each public comment to a code change proposal shall be submitted separately and shall be complete in itself. Each public comment shall contain the following information:

6.4.1 Public comment: Each public comment shall include the name, title, mailing address, telephone number and email address of the public commenter. Email addresses shall be published with the public comments unless the commenter otherwise requests on the submittal form.

If a group, organization, or committee submits a public comment, an individual with prime responsibility shall be indicated. If a public comment is submitted on behalf a client, group, organization or committee, the name and mailing address of the client, group, organization or committee shall be indicated. The scope of the public comment shall be consistent with the scope of the original code change proposal, committee action or successful assembly action. Public comments which are determined as not within the scope of the code change proposal, committee action or successful assembly action shall be identified as such. The public commenter shall be notified that the public comment is considered an incomplete public comment in accordance with Section 6.5.1 and the public comment shall be held until the deficiencies are corrected. A copyright release in accordance with Section 3.3.5.5 shall be provided with the public comment.

6.4.2 Code Reference: Each public comment shall include the code change proposal number.

6.4.3 Multiple public comments to a code change proposal. A proponent shall not submit multiple public comments to the same code change proposal. When a proponent submits multiple public comments to the same code change proposal, the public comments shall be considered as incomplete public comments and processed in accordance with Section 6.5.1. This restriction shall not apply to public comments that attempt to address differing subject matter within a code section.

6.4.4 Desired Final Action: In order for a public comment to be considered, the public comment shall indicate the desired Final Action as one of the following:

1. Approve the code change proposal As Submitted (AS), or
2. Approve the code change proposal As Modified by the committee modification published in the Report of the Committee Action Hearing (AM) or published in a public comment in the Public Comment Agenda (AMPC), or
3. Disapprove the code change proposal (D)

6.4.5 Supporting Information: The public comment shall include a statement containing a reason and justification for the desired Final Action on the code change proposal. Reasons and justification which are reviewed in accordance with Section 6.5 and determined as not germane to the technical issues addressed in the code change proposal or committee action may be identified as such. The public commenter shall be notified that the public comment is considered an incomplete public comment in accordance with Section 6.5.1 and the public comment shall be held until the deficiencies are corrected. The public commenter shall have the right to appeal this action in

accordance with the policy of the ICC Board. A bibliography of any substantiating material submitted with a public comment shall be published with the public comment and the substantiating material shall be made available at the Public Comment_Hearing. Supporting documentation may be provided via a link to a website provided by the public commenter and included in the reason statement and bibliography. The reason statement shall include the date the link was created. All substantiating material published by ICC is material that has been provided by the proponent and in so publishing ICC makes no representations or warranties about its quality or accuracy.

6.4.6 Cost Impact: The proponent of the public comment shall indicate one of the following regarding the cost impact of the public comment to the code change proposal:

- 1) The net effect of the public comment and code change proposal will increase the cost of construction;
- 2) The net effect of the public comment and code change proposal will decrease the cost of construction; or
- 3) The net effect of the public comment and code change proposal will not increase or decrease the cost of construction.

The public commenter shall submit information which substantiates such assertion. This information will be considered at the Public Comment Hearing and will be included in the published public comment. Supporting documentation may be provided via a link to a website provided by the public commenter and included in the cost substantiation statement. The cost substantiation statement shall include the date the link was created.

Any public comment submitted which does not include the requisite cost impact information shall be considered incomplete and shall not be processed.

6.4.7 Online submittal: Each public comment and substantiating information shall be submitted online at the website designated by ICC. Additional copies may be requested when determined necessary by the Secretariat.

6.4.8 Submittal Deadline: ICC shall establish and post the submittal deadline for each cycle. The posting of the deadline shall occur no later than 120 days prior to the public comment deadline. Each public comment shall be submitted online at the website designated by ICC by the posted deadline. The submitter of a public comment is responsible for the proper and timely receipt of all pertinent materials by the Secretariat.

6.5 Review: The Secretariat shall be responsible for reviewing all submitted public comments from an editorial and technical viewpoint similar to the review of code change proposals (see Section 4.2).

6.5.1 Incomplete Public Comment: When a public comment is submitted with incorrect format, without the required information or judged as not in compliance with these Rules of Procedure, the public comment shall not be processed. The Secretariat shall notify the public commenter of

the specific deficiencies and the public comment shall be held until the deficiencies are corrected, or the public comment shall be returned to the public commenter with instructions to correct the deficiencies with a final date set for receipt of the corrected public comment.

6.5.2 Duplications: On receipt of duplicate or parallel public comments, the Secretariat may consolidate such public comments for public comment consideration. Each public commenter shall be notified of this action when it occurs.

6.5.3 Deadline: Public comments received by the Secretariat after the deadline set for receipt shall not be published and shall not be considered as part of the public comment consideration. This deadline shall not apply to public comments submitted by the Code Correlation Committee. In order to correlate submitted public comments with action taken at the Committee Action Hearing on code change proposals that did receive a public comment, the Code Correlation Committee, in conjunction with staff processing of public comments, shall review the submitted public comments and submit the necessary public comments in order to facilitate the coordination of code change proposals. Such review and submittal shall not delay the posting of the Public Comment Agenda as required in Section 6.6.

6.6 Public Comment Agenda: The Committee Action Hearing results on code change proposals that have not received a public comment and code change proposals which received public comments or successful assembly actions shall constitute the Public Comment Agenda. The Public Comment Agenda shall be posted on the ICC website at least 30 days prior the Public Comment Hearing. Any errata to the Public Comment Agenda shall be posted on the ICC website as soon as possible. Code change proposals and public comments which have not been published in the original posting or subsequent errata shall not be considered.

7.0 Public Comment Hearing_

7.1 Intent: The Public Comment Hearing is the first of two steps to make a final determination on all code change proposals which have been considered in a code development cycle by a vote cast by eligible voters (see Section 9.0). The second step, which follows the Public Comment Hearing, is the Online Governmental Consensus Vote that is conducted in accordance with Section 8.0.

7.2 Date and Location: The date and location of the Public Comment Hearing shall be announced not less than 60 days prior to the date of the hearing.

7.3 Moderator: The ICC President shall appoint one or more Moderators who shall act as presiding officer for the Public Comment Hearing.

7.4 Public Comment Agenda: The Public Comment Consent Agenda shall be comprised of code change proposals which have neither a successful assembly action nor public comment. The agenda for public testimony and individual consideration shall be comprised of proposals which have a successful assembly action or public comment (see Section 6.1).

7.5 Procedure: *The Robert's Rules of Order* shall be the formal procedure for the

conduct of the Public Comment Hearing except as these Rules of Procedure may otherwise dictate.

7.5.1 Open Hearing: The Public Comment Hearing is an open hearing. Any interested person may attend and participate in the floor discussion.

7.5.2 Agenda Order: The Secretariat shall publish a Public Comment Agenda for the Public Comment Hearing, placing individual code change proposals and public comments in a logical order to facilitate the hearing. The proponents or opponents of any code change proposal or public comment may move to revise the agenda order as the first order of business at the public hearing, or at any time during the hearing except while another proposal is being discussed. Preference shall be given to grouping like subjects together and for moving items back to a later position on the agenda as opposed to moving items forward to an earlier position.

7.5.2.1 Proponent Approval: A motion to revise the agenda order is considered in order unless the proponent(s) of the moved code change proposals are in attendance at the hearing and object to the move. Where such objections are raised, the motion to revise the hearing order shall be ruled out of order by the Moderator. The ruling of the Moderator shall be final and not subject to a point of order in accordance with Section 5.4.8. The motion to change the hearing order is not debatable.

7.5.2.2 Revised Agenda Order Approved: A motion to revise the agenda order is subject to a 2/3 vote of those present.

7.5.3 Tabling: Tabling of code change proposals shall be permitted. The motion to table is considered in order unless the proponent(s) of the tabled code change proposals are in attendance at the hearing and object to the tabling. Where such objections are raised, the motion to table shall be ruled out of order by the Moderator. The ruling of the Moderator shall be final and not subject to a point of order in accordance with Section 5.4.8. The motion to table is not debatable.

The motion to table must identify one of the following as to the location in the agenda when or where the code change proposal(s) will be considered:

1. To a specific date and time within the timeframe of the Public Comment Agenda for the code change proposals under consideration, or
2. To a specific location in the Public Comment Agenda for the code change proposals under consideration.

7.5.3.1 Tabling approved: A motion to table is subject to a 2/3 vote of those present.

7.5.3.2 Tabled code change proposals back to the floor: The Moderator shall bring the tabled code change proposal(s) back to the floor at the applicable time/agenda location in accordance with Section 7.5.3 Items 1 or 2. The testimony on the code change proposal shall resume at the point in the

process where the tabling occurred.

- 7.5.4 Presentation of Material at the Public Comment Hearing:** Information to be provided at the hearing shall be limited to verbal presentations. Each individual presenting information at the hearing shall state their name and affiliation, and shall identify any entities or individuals they are representing in connection with their testimony. Audio-visual presentations are not permitted. Substantiating material submitted in accordance with Section 6.4.5 and other material submitted in response to a code change proposal or public comment shall be located in a designated area in the hearing room.
- 7.5.5 Public Comment Consent Agenda:** The Public Comment Consent Agenda (see Section 7.4) shall be placed before the assembly with a single motion for Final Action in accordance with the results of the Committee Action Hearing. When the motion has been seconded, the vote shall be taken with no testimony being allowed. A simple majority (50% plus one) based on the number of votes cast by eligible voters shall decide the motion. This action shall not be subject to the Online Governmental Consensus Vote following the Public Comment Hearing (see Section 8.0).
- 7.5.6 Public Comment Individual Consideration Agenda:** Upon completion of the Public Comment Consent Agenda vote, all code change proposals not on the Public Comment Consent Agenda shall be placed before the assembly for individual consideration of each item (see Section 7.4).
- 7.5.7 Reconsideration:** There shall be no reconsideration of a code change proposal after it has been voted on in accordance with Section 7.5.9.
- 7.5.8 Time Limits:** Time limits shall be established as part of the agenda for testimony on all code change proposals at the beginning of each hearing session. Each person requesting to testify on a code change proposal shall be given equal time. In the interest of time and fairness to all hearing participants, the Moderator shall have limited authority to modify time limitations on debate. The Moderator shall have the authority to adjust time limits as necessary in order to complete the hearing agenda.
- 7.5.8.1 Time Keeping:** Keeping of time for testimony by an individual shall be by an automatic timing device. Remaining time shall be evident to the person testifying. Interruptions during testimony shall not be tolerated. The Moderator shall maintain appropriate decorum during all testimony.
- 7.5.9 Discussion and Voting:** Discussion and voting on code change proposals being individually considered shall be in accordance with the following procedures and the voting majorities in Section 7.6:
- 7.5.9.1 Proponent testimony:** The Proponent of a public comment is permitted to waive an initial statement. The Proponent of the public comment shall be permitted to have the amount of time that would have been allocated during the initial testimony period plus the amount of time that would be

allocated for rebuttal. Where a public comment is submitted by multiple proponents, this provision shall permit only one proponent of the joint submittal to waive an initial statement.

- 7.5.9.2 Points of Order:** Any person participating in the public hearing may challenge a procedural ruling of the Moderator. A majority vote of ICC Members in attendance shall determine the decision.
- 7.5.9.3 Eligible voters:** Voting shall be limited to eligible voters in accordance with Section 9.0.
- 7.5.9.4 Allowable Final Action Motions:** The only allowable motions for Final Action are Approval as Submitted (AS), Approval as Modified by the committee (AM) or by one or more modifications published in the Public Comment Agenda (AMPC), and Disapproval (D).
- 7.5.9.5 Initial Motion:** The code development committee action shall be the initial motion considered.
- 7.5.9.6 Motions for Modifications:** Whenever a motion under consideration is for Approval as Submitted or Approval as Modified, a subsequent motion and second for a modification published in the Public Comment Agenda may be made (see Section 6.4.4). Each subsequent motion for modification, if any, shall be individually discussed and voted before returning to the main motion. A two-thirds majority based on the number of votes cast by eligible voters shall be required for a successful motion on all modifications.
- 7.5.9.7 Voting:** After dispensing with all motions for modifications, if any, and upon completion of discussion on the main motion, the Moderator shall then ask for the vote on the main motion. The vote on the main motion shall be taken electronically with the vote recorded and each vote assigned to the eligible voting member. In the event the electronic voting system is determined not to be used by ICC, a hand/standing count will be taken by the Moderator. If the motion fails to receive the majority required in Section 7.6, the Moderator shall ask for a new motion.
- 7.5.9.8 Subsequent Motion:** If the initial motion is unsuccessful, a motion for either Approval as Submitted or Approval as Modified by one or more published modifications is in order. A motion for Disapproval is not in order. The vote on the main motion shall be taken electronically with the vote recorded and each vote assigned to the eligible voting member. In the event the electronic voting system is determined not to be used by ICC, a hand/standing count will be taken by the Moderator. If a successful vote is not achieved, Section 7.5.9.9 shall apply.
- 7.5.9.9 Failure to Achieve Majority Vote at the Public Comment Hearing.** In the event that a code change proposal does not receive any of the required majorities in Section 7.6, the

results of the Public Comment Hearing for the code change proposal in question shall be Disapproval. The vote count that will be reported as the Public Comment Hearing result will be the vote count on the main motion in accordance with Section 7.5.9.7.

7.5.9.10 Public Comment Hearing Results: The result and vote count on each code change proposal considered at the Public Comment Hearing shall be announced at the hearing. In the event the electronic voting system is not utilized and a hand/standing count is taken in accordance with Sections 7.5.9.7 and 7.5.9.8, the vote count will not be announced if an individual standing vote count is not taken. The results shall be posted and included in the Online Governmental Consensus Ballot (see Section 8.2).

7.6 Majorities for Final Action: The required voting majority for code change proposals individually considered shall be based on the number of votes cast of eligible voters at the Public Comment Hearing shall be in accordance with the following table:

Committee Action	Desired Final Action		
	AS	AM/AMPC	D
AS	Simple Majority	2/3 Majority	Simple Majority
AM	2/3 Majority	Simple Majority to sustain the Committee Action or; 2/3 Majority on each additional modification and 2/3 Majority on entire code change proposal for AMPC	Simple Majority
D	2/3 Majority	2/3 Majority	Simple Majority

8.0 Online Governmental Consensus Vote

8.1 Public Comment Hearing Results: The results from the Individual Consideration Agenda at the Public Comment Hearing (see Sections 7.5.6 and 7.5.9.10) shall be the basis for the Online Governmental Consensus Vote. The ballot shall include the voting options in accordance with the following table:

Committee Action	Public Comment Hearing result and Voting Majority	Online Governmental Consensus Ballot and Voting Majority	
AS	AS: Simple Majority	AS: Simple Majority	D: Simple Majority
	AMPC: 2/3 Majority	AMPC: 2/3 Majority	D: Simple Majority
	D: Simple Majority	AS: Simple Majority	D: Simple Majority
AM	AS: 2/3 Majority	AS: 2/3 Majority	D: Simple Majority
	AM: Simple Majority	AM: Simple Majority	D: Simple Majority
	AMPC: 2/3 Majority	AMPC: 2/3 Majority	D: Simple Majority
	D: Simple Majority	AM: Simple Majority	D: Simple Majority

D	AS: 2/3 Majority	AS: 2/3 Majority	D: Simple Majority
	AMPC: 2/3 Majority	AMPC: 2/3 Majority	D: Simple Majority
	D: Simple Majority	AS: 2/3 Majority	D: Simple Majority

8.2 Online Governmental Consensus Ballot: The ballot for each code change proposal considered at the Public Comment Hearing will include:

1. The Public Comment Hearing result and vote count.
2. The allowable Online Governmental Consensus Vote actions in accordance with Section 8.1.
3. Where the Public Comment Hearing result is As Submitted (AS) or Disapproval (D), the original code change proposal will be presented.
4. Where the Public Comment Hearing result is As Modified by the committee (AM) or As Modified by one or more Public Comments (AMPC), the original code change and approved modification(s) will be presented.
5. The committee action taken at the Committee Action Hearing.
6. ICC staff identification of correlation issues.
7. For those who voted at the Public Comment Hearing, the ballot will indicate how they voted, unless an electronic vote count is not taken in accordance with Section 7.5.9.10.
8. An optional comment box to provide comments.
9. Access to the Public Comment Agenda which includes: the original code change, the report of the committee action and the submitted public comments.
10. Access to the audio and video of the Committee Action and Public Comment Hearing proceedings.
11. Identification of the ballot period for which the online balloting will be open.

8.3 Voting process: Voting shall be limited to eligible voters in accordance with Section 9.0. Eligible voters are authorized to vote during the Public Comment Hearing and during the Online Governmental Consensus Vote; however, only the last vote cast will be included in the final vote tabulation. The ballot period will not be extended beyond the published period except as approved by the ICC Board.

8.3.1 Participation requirement: A minimum number of participants to conduct the Online Governmental Consensus Vote shall not be required unless the code change proposal(s) were not voted upon utilizing the electronic voting devices at the Public Comment Hearing and the resulting vote was not assigned to each eligible voting member in accordance with Sections 7.5.9.7 and 7.5.9.8 . If this occurs, a minimum number of participants shall be required for those code change proposal(s) based on an assessment of the minimum number of votes cast during the entire Public Comment Hearing and the Online Governmental Consensus Vote shall determine the final on action on the code change proposal(s) in accordance with Section 10.1.

9.0 Eligible Final Action Voters

9.1 Eligible Final Action Voters: Eligible Final Action voters include ICC Governmental Member Voting Representatives and Honorary Members in good standing who have been confirmed by ICC in accordance with the Electronic Voter Validation System. Such confirmations are required to be revalidated once each code development cycle. After initial validation,

changes to the list of GMVRs for the remainder of the code development cycle shall be made in accordance with Section 9.2. Eligible Final Action voters in attendance at the Public Comment Hearing and those participating in the Online Governmental Consensus Vote shall have one vote per eligible voter on all Codes. Individuals who represent more than one Governmental Member shall be limited to a single vote.

9.2 Applications: Applications for Governmental Membership must be received by the ICC at least 30 days prior to the Committee Action Hearing in order for its designated representatives to be eligible to vote at the Public Comment Hearing or Online Governmental Consensus Vote. Applications, whether new or updated, for Governmental Member Voting Representative status must be received by the Code Council 30 days prior to the commencement of the first day of the Public Comment Hearing in order for any designated representative to be eligible to vote. An individual designated as a Governmental Member Voting Representative shall provide sufficient information to establish eligibility as defined in the ICC Bylaws. The Executive Committee of the ICC Board, in its discretion, shall have the authority to address questions related to eligibility.

10.0 Tabulation, certification and posting of results

10.1 Tabulation and Validation: Following the closing of the online ballot period, the votes received will be combined with the vote tally at the Public Comment Hearing to determine the final vote on the code change proposal. If a hand/standing count is utilized per Subsection 7.5.9.7 or 7.5.9.8, those votes of the Public Comment Hearing will not be combined with the online ballot. ICC shall retain a record of the votes cast and the results shall be certified by a validation committee appointed by the ICC Board. The validation committee shall report the results to the ICC Board, either confirming a valid voting process and result or citing irregularities in accordance with Section 10.2.

10.2 Voting Irregularities: Where voting irregularities or other concerns with the Online Governmental Consensus Voting process which are material to the outcome or the disposition of a code change proposal(s) are identified by the validation committee, such irregularities or concerns shall be immediately brought to the attention of the ICC Board. The ICC Board shall take whatever action necessary to ensure a fair and impartial Final Action vote on all code change proposals, including but not limited to:

1. Set aside the results of the Online Governmental Consensus Vote and have the vote taken again.
2. Set aside the results of the Online Governmental Consensus Vote and declare the Final Action on all code change proposals to be in accordance with the results of the Public Comment Hearing.
3. Other actions as determined by the ICC Board.

10.3 Failure to Achieve Majority Vote: In the event a code change proposal does not receive any of the required majorities for Final Action in Section 8.0, Final Action on the code change proposal in question shall be Disapproval.

10.4 Final Action Results: The Final Action on all code change proposals shall be published as soon as practicable after certification of the results. The results shall include the Final Action taken, including the vote tallies from both the Public Comment Hearing and Online Governmental Consensus Vote, as well the required majority in accordance with Section 8.0. ICC shall maintain a

record of individual votes for auditing purposes, however, the record shall not be made public. The exact wording of any resulting text modifications shall be made available to any interested party.

11.0 Code Publication

11.1 Next Edition of the Codes: The Final Action results on code change proposals shall be the basis for the subsequent edition of the respective Code.

11.2 Code Correlation: The Code Correlation Committee is authorized to resolve technical or editorial inconsistencies resulting from actions taken during the code development process by making appropriate changes to the text of the affected code. The process to resolve technical or editorial inconsistencies shall be conducted in accordance with CP#44 Code Correlation Committee.

12.0 Appeals

12.1 Right to Appeal: Any person may appeal an action or inaction in accordance with Council Policy 1 Appeals. Any appeal made regarding voter eligibility, voter fraud, voter misrepresentation or breach of ethical conduct must be supported by credible evidence and must be material to the outcome of the final disposition of a code change proposal(s).

The following actions are not appealable:

1. Variations of the results of the Public Comment Hearing compared to the Final Action result in accordance with Section 10.4.
2. Denied requests to extend the voter balloting period in accordance with Sections 5.7.4 or 8.3.
3. Lack of access to the internet based online collaboration and voting platform to submit a code change proposal, to submit a public comment or to vote.
4. Code Correlation Committee changes made in accordance with Section 11.2.

13.0 Violations

13.1 ICC Board Action on Violations: Violations of the policies and procedures contained in this Council Policy shall be brought to the immediate attention of the ICC Board for response and resolution. Additionally, the ICC Board may take any actions it deems necessary to maintain the integrity of the code development process.

Section revised in January 22, 2019 revision to CP-28:

9.1

Sections revised in October 20, 2018 revision to CP-28:

2.4

2.4.1

2.4.1.1

2.4.1.2

2.4.2

2.4.2.1

2.4.2.2

2.4.2.3
2.4.2.4
2.4.2.5
2.4.2.6
2.4.2.7
2.4.2.8
2.4.2.9
2.4.2.10
2.4.2.11

Sections revised in July 27, 2018 revision to CP-28:

4.6.1

Sections revised in December 8, 2017 revision to CP-28:

3.3.5.5
8.3.1

Sections revised in September 9, 2017 revision to CP-28:

3.2
3.3.5.3
3.3.5.4
3.3.5.6
3.6.3.1.1
3.6.3.1.2
4.6
5.4.4
5.4.4.1
5.4.4.2
5.4.5
5.4.5.1
5.4.5.2
5.5.2
5.5.2.2
6.4.5
6.4.6
7.5.2
7.5.2.1
7.5.2.2
7.5.3
7.5.3.1
7.5.3.2
7.5.9.10
8.2 – Number 7
11.2

WITHDRAWN CODE CHANGE PROPOSALS

The following code change proposal was withdrawn subsequent to the Committee Action Hearings:

FS4-19

Code change proposals withdrawn prior to the end of the committee action hearings are indicated as such in the 2019 Report of Committee Action Hearings.

2019 PUBLIC COMMENT HEARING SCHEDULE

October 23 - 30, 2019

Rio Hotel and Convention Center
Las Vegas, NV

The upcoming 2019 ICC Annual Conference, Group B Public Comment Hearings and Building Safety & Design Expo will be utilizing the same schedule as last year. The Annual Business meeting will be on Monday, October 21st, followed by the Expo and Education Programs. The conference activities will conclude on Tuesday, October 22nd with the Annual Banquet. Global Connections Day will be held on Wednesday. [Click here](#) for the conference schedule.

The Public Comment Hearings will start on Wednesday, October 23rd at **12:00 pm (please note start time)**. The schedule anticipates that the hearings will be completed no later than 7:00 pm on Wednesday, October 30th. This may require adjustments to the daily start/end times based on hearing progress. The hearings will start with the Building related codes, starting with the I-Code Administrative provisions, followed by the Existing building code, Building code and Residential code. The hearings will conclude with the Green (Chapter 1) and Energy codes.

Unless noted by “Start no earlier than 8 am”, the hearing on each code will begin immediately upon completion of the hearing for the prior code. This includes moving the code up or back from the day indicated based on hearing progress. Actual start times for each code cannot be stipulated due to uncertainties in hearing progress. Be sure to review the tentative hearing order in the Public Comment Agenda (to be posted by September 3rd) for code changes that are heard with a code other than that indicated by the code change prefix (see note 4).

Wednesday October 23	Thursday October 24	Friday October 25	Saturday October 26	Sunday October 27	Monday October 28	Tuesday October 29	Wednesday October 30
Start 12 pm	Start 8 am	Start 8 am	Start 8 am	Start 10 am	Start 8 am	Start 8 am	Start 8 am
ADMIN	IEBC – S	IBC – S	IRC – B	IECC – R/ IRC - E	IECC – R IRC – E	IECC - C	IECC - C
IEBC	IBC – S	IRC – B	IgCC		IECC - C		
IEBC – S		Start no earlier than 8 am	IECC – R/ IRC – E				
End 7 pm	End 7 pm	End 7 pm	End 7 pm	End 7 pm	End 7 pm	End 7 pm	Finish 7 pm

SEE NEXT PAGE FOR SCHEDULE NOTES AND LIST OF CODES

Hearing Schedule Notes:

1. Daily start and end hearing times are subject to change based on progress.
2. Mid-morning, lunch and mid-afternoon breaks to be announced. The hearings are scheduled without a dinner break. A lunch break is not scheduled for Wednesday, October 23rd.
3. Due to the uncertainties in the hearing process, the start time indicated as "Start no earlier than 8 am" is conservatively estimated and is not intended to be a scheduled target.
4. Consult the hearing order for code changes to be heard with a code other than the code under which the code change is designated.

Codes: (be sure to consult the Cross Index of Proposed Code Changes with Public Comments for changes heard with a different code)

ADMIN: Chapter 1 of all the I-Codes except the IECC, IgCC and IRC. Also includes the update of currently referenced standards in all of the 2018 Codes, except the IgCC.

IBC-S: IBC Structural provisions. IBC Chapters 15 – 25.

IEBC: IEBC Non-structural provisions.

IEBC – S: IEBC Structural provisions.

IECC – C: IECC Commercial energy provisions.

IECC – R/IRC – E: IECC Residential energy provisions and IRC Energy provisions in Chapter 11.

IgCC: Administration provisions (Chapter 1) of the IgCC. The technical provisions are based on the provisions of ASHRAE Standard 189.1 *Standard for the Design of High-Performance Green Buildings, Except Low-Rise Residential Buildings*.

IRC – B: IRC Building provisions. Chapters 1 – 10.

TENTATIVE HEARING ORDER FOR EACH INDIVIDUAL CONSIDERATION AGENDA

Note: Code changes to be heard out of numerical order or to be heard with a different code designation are indented. Be sure to review the cross index on page xlii for code change which affect codes other than those under their respective code change number prefix.

<u>IADMIN</u>	EB29-19	S9-19	S174-19
<u>(See page 1)</u>	EB35-19	S17-19	S187-19
ADM1-19 Part I	EB38-19	S21-19	S190-19
ADM3-19 Part I	EB39-19	S23-19	S191-19
ADM4-19	EB41-19	S26-19	S193-19
ADM5-19 Part II	EB47-19	S27-19	S194-19
ADM7-19	EB61-19	S29-19	S196-19
ADM10-19 Part II	EB40-19	S37-19	S200-19
ADM12-19	EB80-19	S40-19	
ADM16-19 Part II	EB82-19	S44-19	<u>IRC - BUILDING</u>
ADM19-19	EB94-19	S52-19	<u>(See page 612)</u>
ADM20-19	EB95-19	S60-19	RB1-19
ADM21-19	EB103-19	S72-19	RB2-19
ADM22-19	EB104-19	S75-19	RB5-19
ADM23-19 Part I	EB111-19	S83-19	RB7-19
ADM23-19 Part II	EB133-19	S86-19	RB10-19
ADM24-19 Part I		S87-19	RB11-19
ADM32-19 Part I	<u>IBC - STRUCTURAL</u>	S90-19	RB14-19
ADM32-19 Part II	<u>(Includes</u>	S96-19	RB20-19
ADM33-19 Part II	<u>IBC -General)</u>	S98-19	RB22-19
ADM33-19 Part III	<u>(See page 360)</u>	S100-19	RB25-19
ADM37-19 Part I	EB2-19	S107-19	RB30-19
ADM37-19 Part II	EB16-19	S108-19	RB33-19
ADM39-19 Part II	EB54-19	S113-19	RB40-19
ADM40-19 Part II	EB56-19	S114-19	RB43-19
ADM40-19 Part III	EB145-19	S118-19	RB46-19
ADM43-19 Part II	EB147-19	S119-19	RB53-19
ADM43-19 Part IV	EB149-19	S120-19	RB56-19
ADM44-19	EB161-19	S123-19	RB58-19
ADM45-19	EB163-19	S132-19	RB66-19
ADM47-19	EB164-19	S133-19	RB67-19
	G2-19	S138-19	RB72-19
<u>IEBC</u>	G10-19	S140-19	RB77-19
<u>(See page 256)</u>	G12-19 Part I	S144-19	RB78-19
EB3-19	G12-19 Part II	S146-19	RB81-19
EB6-19	G13-19	S153-19	RB88-19
EB7-19	G14-19	S154-19	RB89-19
EB50-19	S1-19	S156-19	RB90-19
EB5-19	S2-19	S162-19	RB93-19
EB17-19	S3-19	S165-19	RB96-19
EB20-19	S4-19	S166-19	RB102-19
EB25-19	S5-19	S167-19	RB107-19

RB109-19
RB112-19
RB114-19
RB115-19
RB116-19
RB117-19
RB119-19
RB125-19
RB129-19
RB131-19
RB139-19
RB141-19
RB152-19
RB154-19
RB156-19
RB161-19
RB162-19
RB163-19
RB164-19
RB166-19
RB174-19
RB182-19
RB183-19
RB184-19
RB185-19
RB193-19
RB203-19
RB212-19 Part I
RB212-19 Part II
RB213-19
RB219-19
RB221-19
RB231-19
RB238-19
RB241-19
RB242-19
RB243-19
RB248-19
RB255-19
RB256-19
RB257-19
RB258-19
RB261-19
RB262-19
RB272-19
RB273-19
RB274-19
RB276-19
RB277-19
RB280-19
RB281-19
RB286-19
RB288-19

RB289-19
RB291-19
RB292-19
RB299-19
RB300-19
RB301-19
RB302-19

IgCC
(See page 1099)
GG1-19
GG3-19

IECC – RESIDENTIAL
(See page 1109)

CE9-19 Part II
CE12-19 Part II
RE2-19
CE19-19 Part II
RE7
RE10
RE14
RE17
CE54-19 Part II
CE115-19 Part II
RE18-19
RE20-19
RE21-19
RE26-19
RE27-19
RE28-19
RE29-19
RE32-19
RE33-19
RE34-19
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RE110-19
RE112-19
RE115-19
RE116-19
RE117-19
RE119-19
RE121-19
RE126-19
RE130-19
RE132-19 Part I
RE132-19 Part II
RE136-19
RE139-19
RE145-19
RE146-19
RE147-19
RE148 -19
RE151-19
RE153-19
RE154-19
RE155-19
RE156-19
RE157-19
RE161-19
RE165-19
RE166-19
RE171-19
RE176-19
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RE182-19
RE184-19
RE186-19
RE190-19
RE192-19
RE194-19
RE195-19
RE196-19
RE202-19
RE204-19
RE206-19
RE207-19
RE208-19
RE209-19
RE210-19
RE212-19
RE217-19

RE223-19
RE224-19 Part I
RE224-19 Part II

IECC – COMMERCIAL
(See page 1521)

CE1-19 Part I
CE1-19 Part II
CE2-19
CE3-19 Part I
CE3-19 Part II
CE5-19 Part I
CE5-19 Part II
CE6-19 Part I
CE7-19 Part I
CE7-19 Part II
CE15-19 Part I
CE15-19 Part II
CE16-19 Part I
CE16-19 Part II
CE21-19
CE35-19
CE43-19
CE44-19
CE49-19
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CE96-19
CE97-19
CE99-19
CE104-19
CE106-19
CE108-19
CE111-19
CE112-19
CE113-19
CE116-19
CE124-19
CE127-19
CE129-19
CE133-19
CE134-19
CE140 -19

CE150-19 Part I
CE150-19 Part II
CE158-19
CE159-19 Part I
CE159-19 Part II
CE160-19 Part I
CE160-19 Part II
CE162-19
CE181-19
CE185-19
CE188-19
CE198-19
CE199-19
CE209-19
CE213-19
CE215 -19
CE216-19
CD217-19 Part I
CE217-19 Part II
CE218-19
CE219-19
CE220-19
CE224-19
CE226-19
CE229-19
CE233-19
CE237-19
CE238-19
CE239-19
CE240-19
CE242-19
CE246-19
CE247-19
CE255-19 Part I
CE255-19 Part II
CE256-19
CE261-19
CE263-19 Part I
CE263-19 Part II
CE263-19 Part III
CE264-19
 CE262-19
CE265-19

2019 GROUP B ICC CODE DEVELOPMENT CYCLE CROSS INDEX OF PROPOSED CODE CHANGES ON THE PUBLIC COMMENT AGENDA FOR INDIVIDUAL CONSIDERATION

Some of the proposed code changes include sections that are outside of the scope of the chapters or the code listed in the table of 2018-2019 Staff Secretaries on page x. This is done in order to facilitate coordination among the International Codes which is one of the fundamental principles of the International Codes.

Listed in this cross index are proposed code changes that include sections of codes or codes other than those listed on page xlix. For example, IEBC Section 705.3 is proposed for revision in code change S5-19 which is to be heard by the IBC Structural Committee. Chapter 7 of the IEBC is typically the responsibility of the IEBC Code Committee as listed in the table of 2018-2019 Staff Secretaries. It is therefore identified in this cross index. In some instances, there are other subsections that are revised by an identified code change that is not included in the cross index. For example most sections of the IECC – Residential Provisions have revisions to the duplicate section in Chapter 11 of the IRC as noted in each code change proposal. Another example is that all sections of Chapter 1 of every code are designated ADM unless specifically noted in the respective Code listing. This was done to keep the cross index brief enough for easy reference.

This information is provided to assist users in locating all of the proposed code changes that would affect a certain section or chapter. For example, to find all of the proposed code changes that would affect Chapter 2 of the IBC, locate IBC Chapter 2 in the Cross Index of proposed codes changes, then go proposed code changes in the portion of the monograph for the respective proposed change group. For example, the Cross Index indicates that the definition of STORAGE RACKS is contained within proposed code change S161-19. The IBC-Structural portion of the monograph will contain proposed code change S161-19 for your review. While care has been taken to be accurate, there may be some omissions in this list.

Letter prefix: Each proposed change number has a letter prefix that will identify where the proposal is published. The letter designations for proposed changes and the corresponding publications are as follows:

PREFIX	PROPOSED CHANGE GROUP (see monograph table of contents for location)
ADM	Administrative
E	International Building Code - Means of Egress
EB	International Existing Building Code
CE	International Energy Conservation Code – Commercial
RE	International Energy Conservation Code – Energy
F	International Fire Code
FG	International Fuel Gas Code
FS	International Building Code - Fire Safety
G	International Building Code – General
M	International Mechanical Code
PC	ICC Performance Code
P	International Plumbing Code
PSD	International Private Sewage Disposal Code
RE	International Residential Code - Building
S	International Building Code – Structural
SP	International Swimming Pool and Spa Code
WUIC	International Wildland-Urban Interface Code

INTERNATIONAL BUILDING CODE	
Section #	Code Change #
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
Chapter 2	
[A] CHANGE OF OCCUPANCY	ADM3-19 Part I
[A] REPAIR	ADM4-19
TEMPORARY SPECIAL EVENT STRUCTURE (New)	S200-19
Chapter 31	
3103.1.1 (New)	S200-19
3103.5 (New)	S200-19
3103.6 (New)	S200-19
Appendix O (NEW)	ADM44-19
Appendix O (NEW)	ADM45-19
INTERNATIONAL EXISTING BUILDING CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
Chapter 2	
[A] CHANGE OF OCCUPANCY	ADM1-19 Part I, ADM3-19 Part I
[A] REPAIR	ADM4-19
Chapter 7	
705.1	S1-19, S2-19, S9-18
705.3	S5-19
INTERNATIONAL ENERGY CONSERVATION CODE	
Chapter 1	
CHAPTER 1 -- CE	SEE ADM CODE CHANGE PROPOSALS
CHAPTER 1 -- RE	SEE ADM CODE CHANGE PROPOSALS
R101.2	
R101.3 (IRC N1101.2)	CE1-19 Part II, CE3-19 Part II, CE5-19 Part II, CE7-19 Part II
R101.4.1	CE1-19 Part II
R101.5	CE1-19 Part II
R102.1	CE9-19 Part II
R102.1.1 (IRC N1101.4)	CE12-19 Part II
R103.2.2 (IRC N1101.5.2.2) (New)	CE15-19 Part II
R105.4	CE16-19 Part II
R105.4.1 (New)	CE16-19 Part II
R105.4.2 (New)	CE16-19 Part II
R105.4.3 (New)	CE16-19 Part II

Chapter 2 - [RE]	
R202 (IRC N1101.6) AIR-IMPERMEABLE INSULATION	CE19-19 Part II
R202 (IRC N1101.6) BUILDING SITE	CE1-19 Part II
R202 (IRC N1101.6) ELECTRIC VEHICLE SUPPLY EQUIPMENT (New)	CE217-19 Part II
R202 (IRC N1101.6) EV CAPABLE SPACE (New)	CE217-19 Part II
R202 (IRC N1101.6) EV READY SPACE (New)	CE217-19 Part II
R202 (IRC N1101.6) ROOF MEMBRANE PEEL AND REPLACEMENT (New)	CE255-19 Part II
R202 (IRC N1101.6) STRUCTURE (New)	CE1-19 Part II
Chapter 4 - [RE]	
R401.1	CE1-19 Part II
R401.2 (IRC N1101.13)	CE1-19 Part II, CE54-19 Part II
R401.2.1 (IRC 1101.13.1) (New)	CE1-19 Part II
R401.2.1 (IRC 1101.13.1)	CE1-19 Part II, CE54-19 Part II
R401.2.1.1 (IRC N1101.13.1.1) (New)	CE1-19 Part II, CE54-19 Part II
R401.2.1.2 (IRC N1101.13.1.2) (New)	CE54-19 Part II
R401.3 (IRC N1101.14)	CE1-19 Part II
R403.1.2 (IRC N1103.1.2)	CE115-19 Part II
R403.4.1 (IRC N1103.4.1)	CE150-19 Part II
R403.5.1.1 (IRC N1103.5.1.1)	CE159-19 Part II
R403.5.2 (IRC N1103.5.2)	CE159-19 Part II
R403.10 (IRC N1103.10)	CE160-19 Part II
R403.10.1 (IRC N1103.10.1)	CE160-19 Part II
R403.10.3 (IRC N1103.10.3)	CE160-19 Part II
R403.12 (IRC N1103.12)	CE160-19 Part II
R404.2 (IRC N1104.2) (New)	CE217-19 Part II
R404.2.1 (IRC N1104.2.1) (New)	CE217-19 Part II
R404.2.2 (IRC N1104.2.2) (New)	CE217-19 Part II
TABLE R404.2.2 (IRC N1104.2.2) (New)	CE217-19 Part II
R404.2.3 (IRC N1104.2.3) (New)	CE217-19 Part II
Chapter 5 - [RE]	
R503.1.1 (IRC N1109.1.1)	CE255-19 Part II
Appendix RB (New)	
	CE263-19 Part II
INTERNATIONAL FIRE CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS AND THE FOLLOWING
Chapter 2	
[A] CHANGE OF OCCUPANCY	ADM3-19 Part I

INTERNATIONAL FUEL GAS CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
Appendix A (NEW)	ADM43-19 Part I
INTERNATIONAL GREEN CONSTRUCTION CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL MECHANICAL CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL PLUMBING CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL PROPERTY MAINTENANCE CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL PRIVATE SEWAGE DISPOSAL CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL RESIDENTIAL CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
Chapter 2	
[RB] BUILDING	ADM5-19 Part II
[RB] TOWNHOUSE	ADM5-19 Part II
TOWNHOUSE UNIT (NEW)	ADM5-19 Part II
Chapter 3	
R302.2.1, R302.2.2, R302.2.3, R302.2.4, R302.2.6, R310.1	ADM5-19 Part II
Chapter 11	Changes to Chapter 11 of the IRC are Heard by the RE Committee
Appendix U (New)	CE263-19 Part III (Heard by RE)
Appendix U (New)	RE224-19 Part II (Heard by RE)
INTERNATIONAL SWIMMING POOL AND SPA CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL PERFORMANCE CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS
INTERNATIONAL WILDLAND URBAN INTERFACE CODE	
Chapter 1	SEE ADM CODE CHANGE PROPOSALS

**2019 PUBLIC COMMENTS TO THE PROPOSED CHANGES TO THE 2018
INTERNATIONAL CODES**

CODE PAGE

****Codes are ordered in this document based on the order in the hearing schedule****

IADMIN	1
IEBC	256
IBC – General (Heard by IBC – Structural)	360
IBC – Structural	376
IRC – Building	612
IgCC	1099
IECC – (Residential)	1109
IECC – (Commercial).....	1521
CCC	2024

ADM1-19 Part I

IEBC@: [A] 202 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Existing Building Code

Revise as follows:

[A] CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following:

1. A change of occupancy classification.
2. A change from one group to another group within an occupancy classification.
3. Any change in use within a group for which there is a change in application of the requirements of ~~this code~~, the International Building Code.

Reason: The IBC establishes occupancies, thus the IBC and not "this code" should be referenced for a change in use. The IEBC and IECC do not include occupancy classifications. ADM 9-16 Part 1 was a BCAC revised to this definition for consistency between codes. A floor modification changed "specific occupancy classification" to "change in application of the requirements of this code". A public comment changed this definition to a list. The question that has been raised is in the IEBC is this should reference IBC or IEBC/IECC.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial item.

ADM1-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

As Modified

Committee Modification: [A] CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following:

1. A change of occupancy classification.
2. A change from one group to another group within an occupancy classification.
3. Any change in use within a group for which there is a change in application of ~~the requirements the International Building Code code~~ requirements.

Committee Reason: The committee stated that the proposal as modified cleans up the language and makes the intent of the definition clear to industry. Additionally it was stated that it works better within the code body by capturing all the code provisions. (Vote: 13-0)

Assembly Action:

None

Staff Analysis: ADM3-19 Part I deletes item 3 from the definition list that is revised in ADM1-19 Part I.

ADM1-19 Part I

Individual Consideration Agenda

Public Comment 1:

IEBC@: [A] 202 (New), [A] 202 (New)

Proponents:

Emma Gonzalez-Laders, RA, LEED AP, New York State Department of State, representing NYS Department of State (emma.gonzalez-laders@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

[A] CHANGE OF OCCUPANCY. ~~A change in the use of a building or a portion of a building that results in any~~ Any of the following shall be considered a change of occupancy where the code requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation, or sanitation than is existing in the current building or structure:

1. A change of occupancy classification.
2. A change from one group to another group within an occupancy classification.
3. ~~Any change in~~ of use within a group for which there is a change in application of the code requirements.

[A] CHANGE OF USE. A change in the use of a building or a portion of a building, within the same group classification, for which there is a change in application of code requirements.

Commenter's Reason: ADM1-19 should be Approved as Modified by This Public Comment because it does not address all the problems with the definition for a Change of Occupancy. This Public Comment adds a definition for a Change of Use.

Per testimony in opposition to ADM2-19, guidance was needed in the form of one unified proposal that includes all the proposed changes. For the purpose of providing that guidance, this public comment modification also brings into ADM1-19 the changes that were approved in ADM3-19.

Most importantly, this proposal adds a definition for the term Change of Use. The need for clarity in the definition for a Change of Occupancy is evidenced by the number of proposals heard on this topic: ADM1-19, ADM2-19, and ADM 3-19. While ADM1-19 was approved as modified, it does not address the confusion that exists between a "change of use" and a "change of occupancy," which was the chief concern that ADM2-19 sought to address. Sections 1001.2.1 and 1001.2.2 of the Existing Building Code stipulate a distinct set of requirements to be met when a **Change of Use** takes place, and an additional set of requirements for when a **Change of Occupancy** takes place. However, the combined definition for Change of Use and Change of Occupancy does not support that distinction. Providing a separate definition for a Change of Use, which draws from the language of the third bullet in the definition for a Change of Occupancy, would provide clarity and simplify enforcement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposed change is made to provide clarity on an existing code provision and does not increase or decrease the cost of construction.

NOTE: ADM1-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM1-19 Part II

IECC@: 202 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following:

1. A *change of occupancy* classification.
2. A change from one group to another group within an occupancy classification.
3. Any change in use within a group for which there is a change in the application of the requirements of ~~this code~~, the International Building Code.

Reason: The IBC establishes occupancies, thus the IBC and not “this code” should be referenced for a change in use. The IEBC and IECC do not include occupancy classifications. ADM 9-16 Part 1 was a BCAC revised to this definition for consistency between codes. A floor modification changed “specific occupancy classification” to “change in application of the requirements of this code”. A public comment changed this definition to a list. The question that has been raised is in the IEBC is this should reference IBC or IEBC/IECC.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC).

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The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial item.

ADM1-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This change would break the IECC-C. The intent of the IECC-C change of occupancy definition is to address different levels of stringency in the Energy Code. Changing this code to an IBC reference loses the ability to address changes in lighting between an office and a town hall, for example. (Vote: 14-1)

Assembly Action:

None

ADM1-19 Part II

ADM3-19 Part I

IEBC@: [A] 202; IBC@: [A] 202; IFC@: [A] 202; IRC@: [RB] 202

Proposed Change as Submitted

Proponents: Allison Cook, Arlington County, VA, representing VBCOA; Kenney Payne, Moseley Architects, representing AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr, representing Chesterfield County (clementsro@chesterfield.gov); Bob Orr, representing VBCOA (borr@culpepercounty.gov); Charles Vernon, representing VBCOA (cvernon@arlingtonva.us); Shaina Abney (shaina.abney@fairfaxcounty.gov); David Collins, The American Institute of Architects, representing The American Institute of Architects (dcollins@preview-group.com); Michael Williams, representing Virginia Building and Code Officials Association (VBCOA) (mike.williams@harrisonburgva.gov); Christina Jackson, representing City of Norfolk / WICED of VA (christina.reynolds@norfolk.gov)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Existing Building Code

Revise as follows:

[A] CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following Either of the following shall be considered as a change of occupancy where the current IBC requires a greater degree of accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
 2. Any change in the purpose of, or a change in the level of activity within, a building or structure.
- ~~1. A change of occupancy classification.~~
 - ~~2. A change from one group to another group within an occupancy classification.~~
 - ~~3. Any change in use within a group for which there is a change in application of the requirements of this code.~~

2018 International Building Code

Revise as follows:

[A] CHANGE OF OCCUPANCY. A change in the use of a building or a portion a building which results in one of the following Either of the following shall be considered as a change of occupancy where this code requires a greater degree of accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
 2. Any change in the purpose of, or a change in the level of activity within, a building or structure.
- ~~1. A change of occupancy classification.~~
 - ~~2. A change from one group to another group within an occupancy classification.~~
 - ~~3. Any change in use within a group for which there is a change in application of the requirements of this code.~~

2018 International Fire Code

Revise as follows:

[A] CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following Either of the following shall be considered as a change of occupancy where the International Building Code requires a greater degree of accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
 2. Any change in the purpose of, or a change in the level of activity within, a building or structure.
- ~~1. A change of occupancy classification.~~
 - ~~2. A change from one group to another group within an occupancy classification.~~
 - ~~3. Any change in use within a group for which there is a change in the application of the requirements of this code.~~

2018 International Residential Code

[RB] CHANGE OF OCCUPANCY. A change in the use of a building or portion of a building that involves a change in the application of the

requirements of this code.

Reason: The proposed change keeps the language add to the 2018 code regarding change of occupancy classification and change of occupancy within the same classification. By adding the "greater degree" it ensures that businesses are not made to "retro-fit" existing tenant spaces that do not present a risk to the welfare or life safety of the tenants. Any renovations would still need to meet the requirements for alterations of the Existing Building Code.

For example, if a nail salon is change to an office space (assuming the same occupant load), why should the office be required to provide additional electrical outlets (section 1007.4) or new lighting (section 1010.1). There was already a tenant in the space with those conditions. Any life safety issues (such as a need for increased exits or sprinklers) are caught by the "greater degree" language.

The purpose of the Existing Building code should be to allow existing buildings to be renovated and occupied while maintaining the level of safety. It should not be to retrofit the tenant space or building to meet today's code.

Cost Impact: The code change proposal will decrease the cost of construction

This should reduce the cost for business owners/tenants by only applying the change of occupancy requirements of the Existing Building Code if the International Building Code requires a greater degree of any one of the six elements listed.

ADM3-19 Part I

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

2018 International Existing Building Code

[A] CHANGE OF OCCUPANCY. Either of the following shall be considered as a change of occupancy where the current *International Building Code* requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

2018 International Building Code

[A] CHANGE OF OCCUPANCY. Either of the following shall be considered as a change of occupancy where this code requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

2018 International Fire Code

[A] CHANGE OF OCCUPANCY. Either of the following shall be considered as a change of occupancy where the *International Building Code* or this Code requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

Committee Reason: The committee stated that the modification addition of "safety" clarifies to a greater extent what the definition includes. The approval of the proposal was based on the revised language clarifying when a change of occupancy occurs based on when the code requirements that are required for the change in the categories listed are greater than the existing conditions. (Vote: 13-0)

Assembly Action:

None

Staff Analysis: ADM3-19 Part I deletes item 3 from the definition list that is revised in ADM1-19 Part I.

Individual Consideration Agenda

Public Comment 1:

IEBC@: [A] 202, [A] 202 (New)

Proponents:

Emma Gonzalez-Laders, RA, LEED AP, New York State Department of State, representing NYS Department of State (emma.gonzalez-laders@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

[A] CHANGE OF OCCUPANCY. Any of the following shall be considered as a change of occupancy where the current IBC requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.
3. A change of use.

[A] CHANGE OF USE. A change in the use of a building or a portion of a building, within the same group classification, for which there is a change in application of code requirements.

Commenter's Reason: ADM3-19 should be Approved as Modified by This Public Comment because it does not address the confusion that exists between a "change of use" and a "change of occupancy."

Sections 1001.2.1 and 1001.2.2 of the Existing Building Code stipulate a distinct set of requirements to be met when a **Change of Use** takes place, and an additional set of requirements for when a **Change of Occupancy** takes place. Removing the third bullet point from the definition, which references a Change of Use, leaves code users without any guidance in the applicability of Section 1001.2.1. Providing a separate definition for a Change of Use, which draws from the language of the third bullet in the current definition for a Change of Occupancy in the Existing Building Code, would provide clarity and simplify enforcement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is a clarification of existing code provisions.

Public Comment# 1973

NOTE: ADM3-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM3-19 Part II

IECC@: 202

Proposed Change as Submitted

Proponents: Allison Cook, Arlington County, VA, representing VBCOA; Kenney Payne, Moseley Architects, representing AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr, representing Chesterfield County (clementsro@chesterfield.gov); Bob Orr, representing VBCOA (borr@culpepercounty.gov); Charles Vernon, representing VBCOA (cvernon@arlingtonva.us); Shaina Abney (shaina.abney@fairfaxcounty.gov); David Collins, The American Institute of Architects, representing The American Institute of Architects (dcollins@preview-group.com); Michael Williams, representing Virginia Building and Code Officials Association (VBCOA) (mike.williams@harrisonburgva.gov); Christina Jackson, representing City of Norfolk / WICED of VA (christina.reynolds@norfolk.gov)

2018 International Energy Conservation Code

Revise as follows:

CHANGE OF OCCUPANCY. ~~A change in the use of a building or a portion of a building that results in any of the following~~ Either of the following shall be considered as a change of occupancy where the International Building Code requires a greater degree of accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

- ~~1. A change of occupancy classification.~~
- ~~2. A change from one group to another group within an occupancy classification.~~
- ~~3. Any change in use within a group for which there is a change in the application of the requirements of this code.~~

- 1. Any change in the occupancy classification of a building or structure.
- 2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

Reason: The proposed change keeps the language add to the 2018 code regarding change of occupancy classification and change of occupancy within the same classification. By adding the “greater degree” it ensures that businesses are not made to “retro-fit” existing tenant spaces that do not present a risk to the welfare or life safety of the tenants. Any renovations would still need to meet the requirements for alterations of the Existing Building Code.

For example, if a nail salon is change to an office space (assuming the same occupant load), why should the office be required to provide additional electrical outlets (section 1007.4) or new lighting (section 1010.1). There was already a tenant in the space with those conditions. Any life safety issues (such as a need for increased exits or sprinklers) are caught by the “greater degree” language.

The purpose of the Existing Building code should be to allow existing buildings to be renovated and occupied while maintaining the level of safety. It should not be to retrofit the tenant space or building to meet today’s code.

Cost Impact: The code change proposal will decrease the cost of construction

This should reduce the cost for business owners/tenants by only applying the change of occupancy requirements of the Existing Building Code if the International Building Code requires a greater degree of any one of the six elements listed.

ADM3-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal does consider change in energy efficiency requirements to be considered to trigger a change of occupancy. (Vote: 11-4)

Assembly Action:

None

ADM3-19 Part II

ADM4-19

IBC®: [A] 202; IEBC®: [A] 202

Proposed Change as Submitted

Proponents: David Bonowitz, David Bonowitz, S.E., representing Self (dbonowitz@att.net)

2018 International Building Code

Revise as follows:

[A] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of ~~its maintenance or to correct damage~~; correcting damage or restoring the predamage condition.

2018 International Existing Building Code

Revise as follows:

[A] REPAIR. The reconstruction, replacement or renewal of any part of an *existing building* for the purpose of ~~its maintenance or to correct damage~~; correcting damage or restoring the predamage condition.

Reason: This proposal completes an edit from the last cycle to distinguish repair from maintenance. There is already consensus support for this proposal. The 2018 IEBC definition of ROOF REPAIR already has the wording shown here.

In the last cycle, Group A proposal EB26-15 was approved to clarify distinctions in the IEBC between maintenance and repair. Corresponding changes to the definitions of REPAIR and ROOF REPAIR in the IBC and IEBC would be made in Group B with proposal ADM27-16. Here is what happened:

ICC split the proposal, assigning Part I for REPAIR to the Admin Committee and Part II for ROOF REPAIR to the IBC-S Committee.

IBC-S approved its portion, so Part II was done. But because of a snafu in testimony, the Admin Committee became confused and Disapproved Part I. But that was ok, because ...

At the Public Comment Hearing, Part I was easily Approved as Submitted by a show of hands. All good, until ...

OGV voters supported Part I As Submitted, but only with 55% approval. Since the PCH show-of-hands votes could not be added to the OGV votes, the OGV tally did not reach 2/3, so the consensus on Part I could not be approved, leaving the two codes and the two definitions out of coordination. This proposal corrects that snafu.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The change is editorial, for coordination with changes already approved last cycle.

Staff Analysis: There is an errata in the first printing of the 2018 IBC regarding the definition of roof repair. The definition was revised in the run up to the 2018 code. It should read:

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purpose of correcting damage or restoring the predamage condition.

ADM4-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the disapproval was based on the amount of confusion and debate regarding the scope and extent of maintenance and repair and the additional need for clarification about what extent of work is included with the proposed language addition.
(Vote: 13-0)

Assembly Action:

None

ADM4-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Submitted

Commenter's Reason: At the hearing, opponents managed to confuse Admin committee members by forgetting work done in the previous cycle (EB26-15), where the substantive issues were already decided. The committee's reason for Disapproval acknowledges this. In the confusion, ADM 4 -- which is nothing but a clean-up that was basically already approved last cycle -- was disapproved.

At the hearing, opponents argued that removing the word "maintenance" from the definition of "repair" would mean that 1) "repair" only applies when there's damage, 2) simple replacement of worn-out items would now have to be called repairs, and 3) the codes would be left without a definition of maintenance.

On point 1, they are correct! That is the point, as was already decided in the last cycle (EB26-15): Maintenance, covered primarily by the IPMC, preserves an acceptable condition, while repair, covered primarily by the IEBC, corrects an UNacceptable condition.

On point 2, the IEBC already provides for that: Sec 105.2 acknowledges that repairs and maintenance are different and explicitly waives any permit requirement for basic repairs that are traditionally thought of as maintenance, including, for mechanical systems, the "replacement of any part that does not alter its approval or make it unsafe."

On point 3, they are obviously INCORRECT, as we have an entire code, the IPMC, for maintenance, and it is already referenced from IEBC 302.3.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The proposal is editorial, completing work that was already done and approved last cycle.

Public Comment# 1982

ADM5-19 Part II

IRC@: [RB] 202, 202 (New), R302.2.1, R302.2.2, R302.2.3, R302.2.4, R302.2.6, R310.1

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

2018 International Residential Code

Revise as follows:

[RB] BUILDING. Any one- or two-family dwelling or townhouse, or portion thereof, including townhouses, used or intended to be used for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, or any *accessory structure*. For the definition applicable in Chapter 11, see Section N1101.6.

[RB] TOWNHOUSE. A ~~single-family dwelling unit~~ constructed in a group of building that contains three or more attached townhouse units in which each unit extends from foundation to roof and with a yard or public way on not less than two sides, constructed in a group, and used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

Add new definition as follows:

TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and that has a yard or public way on not less than two sides.

Revise as follows:

R302.2.1 Double walls. Each *townhouse unit* shall be separated ~~from other townhouse units~~ by two 1-hour fire-resistance-rated wall assemblies tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

R302.2.2 Common walls. Common walls separating ~~townhouses~~ townhouse units shall be assigned a fire-resistance rating in accordance with Item 1 or 2. The common wall shared by two ~~townhouses~~ townhouse units shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

R302.2.3 Continuity. The fire-resistance-rated wall or assembly separating ~~townhouses~~ townhouse units shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed *accessory structures*.

R302.2.4 Parapets for townhouses. Parapets constructed in accordance with Section R302.2.5 shall be constructed for *townhouses* as an extension of exterior walls or common walls separating townhouse units in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

Exception: A parapet is not required in the preceding two cases where the roof covering complies with a minimum Class C rating as tested in accordance with ASTM E108 or UL 790 and the roof decking or sheathing is of noncombustible materials or fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by not less than nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a distance of not less than 4 feet (1219 mm) on each side of the wall or walls and any openings or penetrations in the roof are not within 4 feet (1219 mm) of the common walls. Fire-retardant-treated wood shall meet the requirements of Sections R802.1.5 and R803.2.1.2.

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.

R302.2.6 Structural independence. Each ~~individual townhouse unit~~ shall be structurally independent.

Exceptions:

1. Foundations supporting *exterior walls* or common walls.
2. Structural roof and wall sheathing from each unit fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. ~~Townhouses~~ Townhouse units separated by a common wall as provided in Section R302.2.2, Item 1 or 2.

R310.1 Emergency escape and rescue opening required. *Basements, habitable attics* and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Storm shelters and *basements* used only to house mechanical *equipment* not exceeding a total floor area of 200 square feet (18.58 m²).
2. Where the *dwelling unit* or *townhouse unit* is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 2.1. One means of egress complying with Section R311 and one emergency escape and rescue opening.
 - 2.2. Two means of egress complying with Section R311.

Reason: Correlation with proposed changes to the IRC to clarify use of the term "townhouse" in both codes. In the IBC, there are currently eight uses of the term "townhouse," including three in the preamble. If this change is approved, it will be necessary to editorially revise only one of those current occurrences, the one in Section 2308.1, which will need to be revised as follows to use the term "townhouse unit." *...Detached one- and two-family dwellings and townhouse units not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the International Residential Code.*

From the IRC proposal reason statement:

The IRC currently contains the terms "townhouse" and "townhouse unit," but only "townhouse" is defined. Here are examples of a few of the locations where the term "townhouse unit" is currently used:

- Preamble "Effective Use of the International Residential Code," which states: The International Residential Code (IRC) was created to serve as a complete, comprehensive code regulating the construction of single-family houses, twofamily houses (duplexes) and buildings consisting of three or more townhouse units."
- Section R302.2 states: Townhouses. Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.
- Appendix K uses the term "townhouse units" throughout to describe individual dwelling units within a townhouse. The term "townhouse" is currently used interchangeably as referencing either a single dwelling unit or as a structure with three or more such units, even though the current definition does not accommodate the latter. Literally, the current definition of "townhouse" is a "townhouse unit," yet previously approved code changes that introduced the term "townhouse unit" clearly demonstrate the confusion. I've also experienced this confusion when attempting to teach townhouse requirements to students in code classes.

This proposal will clarify the term "townhouse" as applying to structures that contain three or more dwelling units. This is consistent with how the IRC uses the term "dwelling" to reference a building with one or two dwelling units. Some of the text in the "dwelling" definition has been reproduced in the proposed "townhouse" definition, even though it's arguably poorly written. My objective was consistency, not fixing existing problems with the "dwelling" definition. It should be noted that, while the term "dwelling" currently captures buildings with up to two dwelling units, there is no term that currently defines a structure with more than two dwelling units. The updated definition of "townhouse" fills that hole.

To accommodate the need for a term that applies to individual dwelling units in a townhouse building, the proposal adds a new definition of "townhouse unit." The new definition is correlated with and uses the term "dwelling unit." For reference, the current IRC definitions of "dwelling" and "dwelling unit" are provided below, along with clean versions of the proposed "townhouse" and "townhouse unit" definitions for comparison:

- [RB] DWELLING. Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.
- [RB] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. For the definition applicable in Chapter 11, see Section N1101.6.
- [RB] TOWNHOUSE. A building that contains three or more attached townhouse units constructed in a group, and used, intended, or designed

to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

- [RB] TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and with a yard or public way on not less than two sides.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Clarifies current code provisions with no intended technical change.

ADM5-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Although this is a good start, the committee disapproved this proposal so that the proponent could further develop it. (Vote: 11-0)

Assembly Action:

None

ADM5-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC@: [RB] 202

Proponents:

Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] TOWNHOUSE. ~~A building that contains three or more attached townhouse units, constructed in a group, and used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.~~

Commenter's Reason: We support the proponent's changes to the townhouse requirements outlined in this proposal. However, the second phrase of the proposed *townhouse* definition can be eliminated because the *townhouse* definition is now a "container" for townhouse units, not the actual units themselves. This information could be relocated to the definition of *townhouse unit*, but it is not necessary. A *townhouse unit* is considered a *dwelling unit* and *dwelling unit* is included in the definition of *dwelling*, which already includes the language in question.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment change clarifies the relationship between the new definitions created by the proponent. It has no monetary impact.

Public Comment# 1566

NOTE: ADM5-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM5-19 Part I

IBC®: [A] 202, 202 (New); IFC®: [A], (New)

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., representing Self (jeff.shapiro@intlcodeconsultants.com)

THIS IS A 3 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. PART III WILL BE HEARD BY THE IECC-RESIDENTIAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows:

[A] TOWNHOUSE. ~~A single-family dwelling unit constructed in a group of building that contains three or more attached townhouse units in which each unit extends from the foundation to roof and with open space on at least two sides, constructed in a group, and used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.~~

Add new definition as follows:

TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and with a yard or public way on not less than two sides.

2018 International Fire Code

[A] TOWNHOUSE. ~~A single-family dwelling unit constructed in a group of building that contains three or more attached townhouse units in which each unit extends from the foundation to roof and with open space on not less than two sides, constructed in a group, and used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.~~

Add new definition as follows:

TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and with a yard or public way on not less than two sides.

Reason: Correlation with proposed changes to the IRC to clarify use of the term "townhouse" in both codes. In the IBC, there are currently eight uses of the term "townhouse," including three in the preamble. If this change is approved, it will be necessary to editorially revise only one of those current occurrences, the one in Section 2308.1, which will need to be revised as follows to use the term "townhouse unit." *...Detached one- and two-family dwellings and townhouse units not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the International Residential Code.*

From the IRC proposal reason statement:

The IRC currently contains the terms "townhouse" and "townhouse unit," but only "townhouse" is defined. Here are examples of a few of the locations where the term "townhouse unit" is currently used:

- Preamble "Effective Use of the International Residential Code," which states: The International Residential Code (IRC) was created to serve as a complete, comprehensive code regulating the construction of single-family houses, twofamily houses (duplexes) and buildings consisting of three or more townhouse units."
- Section R302.2 states: Townhouses. Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.
- Appendix K uses the term "townhouse units" throughout to describe individual dwelling units within a townhouse. The term "townhouse" is currently used interchangeably as referencing either a single dwelling unit or as a structure with three or more such units, even though the current definition does not accommodate the latter. Literally, the current definition of "townhouse" is a "townhouse unit," yet previously approved code changes that introduced the term "townhouse unit" clearly demonstrate the confusion. I've also experienced this confusion when attempting to teach townhouse requirements to students in code classes.

This proposal will clarify the term "townhouse" as applying to structures that contain three or more dwelling units. This is consistent with how the

IRC uses the term "dwelling" to reference a building with one or two dwelling units. Some of the text in the "dwelling" definition has been reproduced in the proposed "townhouse" definition, even though it's arguably poorly written. My objective was consistency, not fixing existing problems with the "dwelling" definition. It should be noted that, while the term "dwelling" currently captures buildings with up to two dwelling units, there is no term that currently defines a structure with more than two dwelling units. The updated definition of "townhouse" fills that hole.

To accommodate the need for a term that applies to individual dwelling units in a townhouse building, the proposal adds a new definition of "townhouse unit." The new definition is correlated with and uses the term "dwelling unit." For reference, the current IRC definitions of "dwelling" and "dwelling unit" are provided below, along with clean versions of the proposed "townhouse" and "townhouse unit" definitions for comparison:

- *[RB] DWELLING. Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.*
- *[RB] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. For the definition applicable in Chapter 11, see Section N1101.6.*
- *[RB] TOWNHOUSE. A building that contains three or more attached townhouse units constructed in a group, and used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.*
- *[RB] TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and with a yard or public way on not less than two sides.*

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Clarifies current code provisions with no intended technical change.

ADM5-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the disapproval was based on the need for more work to improve the language and the issue of the comparison to the existing definition of dwelling unit to the newly proposed definition of townhouse unit. (Vote: 13-0)

Assembly Action:

None

ADM5-19 Part I

NOTE: ADM5-19 PART III DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM5-19 Part III

IECC: R202 (IRC N1101.6), TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and with a yard or public way on not less than two sides.

Revise as follows:

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
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h. For residences with conditioned basements, R-2 and R-4 residences, and for ~~townhouses~~ townhouse units, the following formula shall be used to determine glazing area:

$$AF = A_s \times FA \times F$$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

L and CFA are in the same units.

Reason: Correlation with proposed changes to the IRC to clarify use of the term "townhouse" in both codes. In the IBC, there are currently eight uses of the term "townhouse," including three in the preamble. If this change is approved, it will be necessary to editorially revise only one of those current occurrences, the one in Section 2308.1, which will need to be revised as follows to use the term "townhouse unit." *...Detached one- and two-family dwellings and townhouse units not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the International Residential Code.*

From the IRC proposal reason statement:

The IRC currently contains the terms "townhouse" and "townhouse unit," but only "townhouse" is defined. Here are examples of a few of the locations where the term "townhouse unit" is currently used:

- Preamble "Effective Use of the International Residential Code," which states: The International Residential Code (IRC) was created to serve as a complete, comprehensive code regulating the construction of single-family houses, twofamily houses (duplexes) and buildings consisting of three or more townhouse units."
- Section R302.2 states: Townhouses. Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.
- Appendix K uses the term "townhouse units" throughout to describe individual dwelling units within a townhouse. The term "townhouse" is currently used interchangeably as referencing either a single dwelling unit or as a structure with three or more such units, even though the current definition does not accommodate the latter. Literally, the current definition of "townhouse" is a "townhouse unit," yet previously approved code changes that introduced the term "townhouse unit" clearly demonstrate the confusion. I've also experienced this confusion when attempting to teach townhouse requirements to students in code classes.

This proposal will clarify the term "townhouse" as applying to structures that contain three or more dwelling units. This is consistent with how the IRC uses the term "dwelling" to reference a building with one or two dwelling units. Some of the text in the "dwelling" definition has been reproduced in the proposed "townhouse" definition, even though it's arguably poorly written. My objective was consistency, not fixing existing problems with the "dwelling" definition. It should be noted that, while the term "dwelling" currently captures buildings with up to two dwelling units, there is no term that currently defines a structure with more than two dwelling units. The updated definition of "townhouse" fills that hole.

To accommodate the need for a term that applies to individual dwelling units in a townhouse building, the proposal adds a new definition of "townhouse unit." The new definition is correlated with and uses the term "dwelling unit." For reference, the current IRC definitions of "dwelling" and "dwelling unit" are provided below, along with clean versions of the proposed "townhouse" and "townhouse unit" definitions for comparison:

- *[RB] DWELLING. Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.*
- *[RB] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. For the definition applicable in Chapter 11, see Section N1101.6.*
- *[RB] TOWNHOUSE. A building that contains three or more attached townhouse units constructed in a group, and used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.*
- *[RB] TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and with a yard or public way on not less than two sides.*

Cost Impact: The code change proposal will not increase or decrease the cost of construction
 Clarifies current code provisions with no intended technical change.

ADM5-19 Part III

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee concluded the definition is in the IRC and should remain there. The proposed definition appears to use the defined term within the definition. (Vote: 11-0)

Assembly Action:

None

ADM5-19 Part III

ADM7-19

IEBC@: [A] 101.2

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

2018 International Existing Building Code

Revise as follows:

[A] 101.2 Scope. The provisions of the this code shall apply to the *repair, alteration, change of occupancy, addition to and relocation of existing buildings.*

Exception: ~~Detached~~ Subject to the approval of the code official, ~~detached~~ one- and two-family *dwelling*s and multiple single-family *dwelling*s (*townhouses*) not more than three *stories above grade plane* in height with a separate *means of egress*, and their accessory structures not more than three *stories above grade plane* in height, shall comply with this code or the International Residential Code.

Reason: This proposal edits a new exception that was just added in the last cycle (ADM 31-16). It preserves the intent of that proposal, but it explicitly gives discretion to the code official, thus ensuring consistency within a jurisdiction. ADM 31-16 added the exception to Section 101.2. The intent was given in the Admin committee's reason statement: "Not mixing codes on the same building will make compliance easier." This is true. By the same token, not mixing codes within a jurisdiction with many similar projects will also make compliance easier and avoid a host of problems. Unfortunately, by giving full discretion to the permit applicant, the new exception creates exactly the problems it meant to solve.

Both the IEBC and the IRC contain provisions for existing dwellings and townhouses. For years, neither code has been completely clear about which code applies in a jurisdiction that adopts both. Rather, that decision has been left to the jurisdiction and its code official. The new exception added to the 2018 IEBC overturned that local practice and removed that local discretion. This proposal restores it.

This proposal will allow jurisdictions that have been using the IEBC for existing dwellings and townhouses to continue doing so. This benefits all stakeholders. First, it supports the local code official and policy-makers who have been using the IEBC without incident. Second, it ensures owners and developers that similar projects will be handled consistently, and consistent with past local precedents. Third, it helps FEMA grant applicants (jurisdictions), and FEMA assistance applicants (owners) comply with FEMA policy, which requires consistent use of the IEBC's upgrade triggers (discussed below). Fourth, it helps insurers and their customers understand and anticipate the costs and benefits of upgrade coverage. The new exception to IEBC Section 101.2 re-opened all those questions, but they can all be answered with this proposal, by allowing jurisdictions to maintain their own precedents and practices.

The proposal is consistent with other IEBC provisions that allow code official discretion. The added words are identical to those used in the exception to IEBC Section 301.3.

Is there a significant difference between the IEBC and the IRC's provisions for existing buildings? Yes, especially with regard to townhouses. The IEBC has 18 provisions that jurisdictions rely on to enhance earthquake, wind, and snow safety in existing townhouses, and ten for existing dwellings. All of these would be lost if a permit applicant is allowed to skip them by invoking the exception to Section 101.2. That said, this does not mean the IEBC treats dwellings just like commercial buildings; on the contrary, the IEBC exempts certain existing dwellings and townhouses from ten different triggers.

Whether one likes these IEBC provisions or not, one must acknowledge that any jurisdiction that has been applying them without incident should be allowed to continue that practice, and that it cannot help consistency to allow such different regulations to apply to similar projects. In many cases, the local code official will want to continue using the IEBC; this proposal allows that. In other cases, the local code official might recognize that the IRC approach is acceptable; this proposal allows that too. But the only way to ensure consistent policy is to have that decision rest with the code official.

Finally, even those who prefer the IRC approach must acknowledge that the new exception will lead to unclear application to individual projects as well. The exception allows ANY existing dwelling or townhouse – even one without conventional framing, or one that violates the conventional framing rules, or is highly deficient, or has irregularities that would make it ineligible for the IRC, or is located in a region that would make it ineligible for the IRC, or is highly vulnerable to wind or earthquake – to use the IRC and avoid addressing those conditions. IRC Section R102.7.1 would be the only applicable provision, and it sets a VERY low bar; it prohibits only projects that would *make* the existing building unsafe. If the existing building is already highly deficient, the IRC sets no limits on alterations, additions, or repairs. By giving discretion to the local code official who best knows the local building stock, the proposal resolves these issues as well.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal merely gives discretion to the jurisdiction and code official to maintain precedents and past practices.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the code official needs consistency in the enforcement of the code and it should not depend on the applicant to determine the requirements. Additionally it was stated that the existing code already addresses this in regards to the responsibility of the code official to determine the requirements. (Vote: 13-0)

Assembly Action:

None

ADM7-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Submitted

Commenter's Reason: In disapproving ADM7-19, the Admin Committee's reason states, "[T]he code official needs consistency in the enforcement of the code and it should not depend on the applicant to determine the requirements."

With respect, this reasoning, as well as the testimony of opponents at the CAH, appears to completely misunderstand the issue in question. ADM7 would modify an existing exception to IEBC Section 101.2. This exception, added only in 2018 with no review by any technical committee (IRC, IEBC, or IBC-S), now lets the permit applicant for any addition, alteration, or repair to any dwelling or townhouse -- no matter how deficient the existing structure, and no matter how extensive the proposed project -- escape the IEBC and use the far more lenient (and mostly nonexistent) provisions of the IRC instead.

In other words, this exception in the CURRENT code does exactly what the Admin committee's reason says NOT to do: 1. It explicitly allows the permit applicant to pick the requirements, and 2. It guarantees that enforcement of existing building provisions within a jurisdiction will be INconsistent.

The current code removes all discretion from the local code official about whether and how to apply the IEBC and IRC to existing dwellings. This is discretion that jurisdictions across the country have been applying and should be allowed to continue applying, based on local precedent and based on expert knowledge of their existing housing stocks. Instead, the 2018 IEBC says the permit applicant now gets to pick the code, sidestepping the IEBC's prudent provisions for deficient structures in areas subject to severe environmental loads.

In response to this fact about the current code, opponents of ADM7 stated in their testimony that to require code official approval for this option forces the code official to make decisions he or she either cannot or does not want to make. What an insult to ICC members! Have the opponents to ADM7 not read IEBC Section 104.11, or IRC Section R104.11? Those sections explicitly vest in the code official the authority -- and the responsibility -- to review alternatives, confirm their adequacy and equivalence by a number of measures, and state their findings in writing. How can anyone argue that this is not within the code official's authority, or worse, that code officials are not up to the task? Here's something else the Admin committee said: "The existing code already addresses this in regards to the responsibility of the code official to determine the requirements." Well, that used to be true, but not anymore. Prior to the 2018 IEBC, an applicant proposing to use the IRC as an alternative to the IEBC would have been subject to this code official discretion per IEBC Sec 104.11. But now, that discretion is given to the applicant alone -- precisely what the Admin committee says it does not want. ADM7-19, as submitted, would rectify that. Quickly, effectively, with ample precedent, and with respect for local practices and expertise.

Opponents also argued that if jurisdictions are concerned about the IRC's lax existing building provisions, they can adopt IRC Appendix J. Who are they kidding? Appendix J is grossly out of date and so rarely used that hardly anyone has noticed that it now actually defers to the IEBC as a better alternative. If every jurisdiction that adopts Appendix J votes *against* ADM7, and every jurisdiction that doesn't votes *for* ADM7, ADM7 will be approved in a landslide.

Opponents also argued that if ADM7 were approved, code officials would need to make discretionary decisions for every minor project, such as a proposal to add a deck to a house. This is absurd. First, minor projects are not treated differently by the two codes, so the question would never even come up. Second, every building department I know has a set of bulletins that state common interpretations in writing, in advance, for

everyone's benefit. If ADM7 were approved, that is exactly the approach every building official would take. They would merely write down, once, those conditions -- adding a deck, say, and lots of others -- for which the IRC would be allowed, and those -- say, putting a second story on a house with an unbraced cripple wall in seismic design category D -- where the IEBC would be wisely applied instead.

Finally, opponents suggested that if jurisdictions don't like the exception to IEBC Section 101.2, they don't have to adopt it. First, that's just disingenuous given the proliferation of amendment-free adoption policies. But more important, is that really the way the supporters of the current exception want to go? They would rather have the whole thing not adopted than add a few words to rely on the wisdom of the local code official? Well, if that's what they want ..., but ADM7-19 seems like a better idea.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal merely maintains existing practices.

Public Comment# 2151

ADM10-19 Part II

IRC@: R101.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins (sehpcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

R101.3 Intent. The purpose of this code is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, structural strength, means of egress facilities, stability, sanitation, light and ventilation, energy conservation and ~~safety to life for~~ providing a reasonable level of life safety and property ~~protection from fire and other hazards attributed the hazards of fire, explosion or dangerous conditions attributed~~ to the built environment, and to provide safety to fire fighters and emergency responders during emergency operations.

Reason: The purpose of this proposal is for consistency in language for the sections on "Intent" or "Purpose" in the family of codes. The title of the section should be revised to be consistent with the text, which is "purpose."

The IFC was used as the guidance for the phrase to use. Several of the codes included the term "property protection", but not all. It is the intent of all the codes to provide "a reasonable level of life safety and property protection". Thus, this phrase is proposed to be used consistently across codes.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

Disapproved

Committee Reason: The committee likes the language as approved in ADM9-19 Part IV. The language in this proposal, "or dangers attributed to the built environment," seems to raise the threshold of when the code gets enforced. The IRC does not explain how to design a building for explosions. The laundry list issue is a real one, even in the intent section. It is important to address the concerns raised by this proposal, but it may be better to bring this back in the public comment period using the language "causes of explosions" and "other" dangerous conditions. (Vote: 10-1)

Assembly Action:

None

ADM10-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC@: R101.3

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R101.3 Intent. The purpose of this code is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, structural strength, means of egress facilities, stability, sanitation, light and ventilation, energy conservation, and for providing a reasonable level of life safety and property protection from the hazards of fire, ~~explosion~~ or dangerous conditions attributed to the built environment, and to provide safety to fire fighters and emergency responders during emergency operations.

Commenter's Reason: Reason: The IRC committee said they preferred ADM9 Part 4, however, the intent of the proposal was for the ADM9 and ADM10 was to work together for all the codes. The floor modification to ADM9 Part 4 was to remove 'explosion'. This public comment is to also remove "explosion" for consistency. Below is what Section R101.3 would look like when ADM9 Part 4 and ADM10 Part 2 were combined. This would be coordinated with the twelve ICC codes revised by ADM10 Part 1 (IBC, IFC, IEBC, IPC, IMC, IPSDC, IFGC, ISPSC, IPMC, IZC, IWUICC and ICCPC)

R101.3. Purpose. The purpose of this code is to establish minimum requirements to provide a reasonable level of safety, health and general welfare through affordability, structural strength, means of egress, stability, sanitation, light and ventilation, energy conservation and for providing a reasonable level of life safety and property protection from the hazards of fire or dangerous conditions, and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

Public Comment# 1203

Public Comment 2:

IRC@: R101.3

Proponents:

Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R101.3 Intent. The purpose of this code is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, structural strength, means of egress facilities, stability, sanitation, light and ventilation, energy conservation and for providing a reasonable level of life safety and property protection from ~~the hazards of fire, explosion or dangerous conditions~~ or other hazards attributed to the built environment, and to provide safety to fire fighters and emergency responders during emergency operations.

Commenter's Reason: I support the BCAC's efforts to make the Administrative provisions of all the codes be similar. But they do not have to all be exactly the same since they do not all apply to the same buildings or address the same hazards.

There were objections raised during the Committee Action hearings regarding the addition of the word "explosion" so that is deleted. There was also concern raised that only listing three hazards resulted in a "laundry list" that left out other hazards that are meant to be addressed by the IRC. For example, a good bit of the framing requirements of the IRC are designed to resist the natural hazards of high wind or earthquakes, yet these are left out of the list. So keeping the words "other hazards attributed to the built environment" will include all these other hazards that the IRC is written to resist. The net result of this is that the "hazards" wording is rearranged to more closely resemble the existing 2018 IRC language, with the addition of "dangerous conditions".

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There should be no cost impact. Just editorial rewrite of the original proposal. This does not contain any technical requirements, it is in the Administrative Chapter.

Public Comment# 2160

NOTE: ADM10-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM10-19 Part I

IBC®: [A] 101.3; IEBC®: [A] 101.3; ISPSC®: [A] 101.3; IPMC®: [A] 101.3; IZC®: [A] 101.2

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); David Collins (sehpcac@iccsafe.org)

THIS IS A 4 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. PART III WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. PART IV WILL BE HEARD BY THE IECC-RESIDENTIAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows:

[A] 101.3 **Intent.** The purpose of this code is to establish the minimum requirements to provide a reasonable level of safety, public health and general welfare through structural strength, *means of egress* facilities, stability, sanitation, adequate light and ventilation, energy conservation, and ~~safety to life for providing a reasonable level of life safety~~ and property protection from the hazards of fire, explosion and other hazards or dangerous conditions, and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

2018 International Existing Building Code

Revise as follows:

[A] 101.3 **Intent.** The intent of this code is to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to safeguard the public health, safety ~~and~~, property protection and welfare insofar as they are affected by the *repair, alteration, change of occupancy, addition* and relocation of *existing buildings*.

2018 International Swimming Pool and Spa Code

Revise as follows:

[A] 101.3 **Intent.** The purpose of this code is to establish minimum standards to provide a reasonable level of safety, ~~and protection of health,~~ property protection and public welfare by regulating and controlling the design, construction, installation, quality of materials, location and maintenance or use of pools and spas.

2018 International Property Maintenance Code

Revise as follows:

[A] 101.3 **Intent.** This code shall be construed to secure its expressed intent, which is to ensure public health, safety, property protection and welfare insofar as they are affected by the continued *occupancy* and maintenance of structures and *premises*. Existing structures and *premises* that do not comply with these provisions shall be altered or repaired to provide a minimum level of health and safety as required herein.

2018 International Zoning Code

Revise as follows:

[A] 101.2 **Intent.** The purpose of this code is to safeguard the health, property protection and public welfare by controlling the design, location, use or occupancy of all buildings and structures through the regulated and orderly development of land and land uses within this jurisdiction.

Reason: The purpose of this proposal is for consistency in language for the sections on "Intent" or "Purpose" in the family of codes. The title of the section should be revised to be consistent with the text, which is "purpose."

The IFC was used as the guidance for the phrase to use. Several of the codes included the term "property protection", but not all. It is the intent of all the codes to provide "a reasonable level of life safety and property protection". Thus, this phrase is proposed to be used consistently across codes.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM10-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

As Submitted

Committee Reason: The committee stated that the reason for approval was that the proposal provides consistency in the code language which improves the interpretation across the I-Code family. (Vote: 13-0)

Assembly Action:

None

ADM10-19 Part I

NOTE: ADM10-19 PART III DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM10-19 Part III

IECC@: C101.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. ~~This code shall regulate the design and construction.~~ The purpose of this code is to establish minimum requirements to provide a reasonable level of health, safety, property protection and general welfare by regulating the design, construction and operation of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: The purpose of this proposal is for consistency in language for the sections on "Intent" or "Purpose" in the family of codes. The title of the section should be revised to be consistent with the text, which is "purpose."

The IFC was used as the guidance for the phrase to use. Several of the codes included the term "property protection", but not all. It is the intent of all the codes to provide "a reasonable level of life safety and property protection". Thus, this phrase is proposed to be used consistently across codes.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM10-19 Part III

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Consistent with action on ADM9-19, this removes the only good part of ADM9 and keeps the bad pieces. Consistent with the action on CE5. (Vote 15-0)

Assembly Action:

None

ADM10-19 Part III

NOTE: ADM10-19 PART IV DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM10-19 Part IV

IECC@: R101.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

R101.3 Intent. ~~This code shall regulate the design and construction~~ The purpose of this code is to establish minimum requirements to provide a reasonable level of health, safety, property protection and general welfare by regulating the design, construction and operation of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: The purpose of this proposal is for consistency in language for the sections on "Intent" or "Purpose" in the family of codes. The title of the section should be revised to be consistent with the text, which is "purpose."
The IFC was used as the guidance for the phrase to use. Several of the codes included the term "property protection", but not all. It is the intent of all the codes to provide "a reasonable level of life safety and property protection". Thus, this phrase is proposed to be used consistently across codes.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac/>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM10-19 Part IV

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Consistent with reason for Disapproval of ADM9-19 - Part III. (Vote: 11-0)

Assembly Action:

None

ADM10-19 Part IV

ADM12-19

IMC@: [A] 102.3 (New), ACCA Chapter 15 (New)

Proposed Change as Submitted

Proponents: David Bixby, Air Conditioning Contractors of America (ACCA), representing Air Conditioning Contractors of America (bixster1953@yahoo.com)

2018 International Mechanical Code

Revise as follows:

[A] 102.3 Maintenance. Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by this code shall be maintained in compliance with the edition of the code under which they were installed. The owner or the owner's authorized agent shall be responsible for maintenance of mechanical systems. To determine compliance with this provision, the code official shall have the authority to require a mechanical system to be reinspected.

The inspection for maintenance of HVAC systems not within the scope of ACCA 4 QM shall be performed in accordance with ASHRAE/ACCA/ANSI Standard 180.

The inspection for maintenance of HVAC systems in one and two family dwellings and multi family dwellings of three stories or fewer above grade shall be performed in accordance with ACCA 4 QM.

Add new standard(s) as follows:

ACCA

Air Conditioning Contractors of America
2800 Shirlington Road, Suite 300
Arlington VA 22206

ANSI/ACCA 4 QM – 2013: Maintenance of Residential HVAC Systems

Reason: The proposal is to (1) clarify that the current requirement showing Standard 180 specifically covers inspection for maintenance of commercial HVAC systems, and (2) add a reference to ACCA 4 QM which covers inspection for maintenance of residential HVAC systems for one- and two-family dwellings of three stories or less. ACCA 4 QM is a consensus-based ANSI standard. A proposal to add ACCA 4 QM to Chapter 15, Referenced Standards, has also been submitted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
No cost impacts since this is a clarification of maintenance requirements.

Staff Analysis: A review of the standard proposed for inclusion in the code, ANSI/ACCA 4 QM – 2013: Maintenance of Residential HVAC Systems, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

ADM12-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reason for disapproval was that the scope of the IMC does not include IRC dwellings and that the proposed referenced standard addition was unnecessary. (Vote: 13-0)

Assembly Action:

None

ADM12-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

David Bixby, representing Air Conditioning Contractors of America (bixster1953@yahoo.com)

requests As Submitted

Commenter's Reason: ACCA requests approval of the proposal as submitted. The Committee's reason for rejection was that "the scope of the IMC does not include IRC dwellings" and that the proposed addition of ACCA 4 QM was "unnecessary." The existing requirement requires inspection for maintenance to be performed in accordance with ASHRAE/ACCA/ANSI Standard 180. This standard does not cover inspection for maintenance in one and two family dwellings and multi-family dwellings of three stories or fewer above grade. ACCA 4 QM covers such dwellings. The proposal is merely clarifying the current requirement and adding a reference to ACCA 4 QM for dwellings not covered by Standard 180. ACCA 4 QM is a consensus-based ANSI standard. If the Committee approves ACCA's proposal then a reference to ACCA 4 QM needs to be added to Chapter 15, Referenced Standards.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There will be no cost impacts since this is a clarification of maintenance requirements.

Public Comment# 1981

ADM16-19 Part II

IRC@: SECTION R103, R103.1, R103.2, R103.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins (sehpcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R103 DEPARTMENT OF BUILDING SAFETY CODE COMPLIANCE AGENCY

R103.1 Creation of enforcement agency. The ~~department of building safety~~ [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the building ~~official~~ official. ~~The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.~~

R103.2 Appointment. The building official shall be appointed by the chief appointing authority of the jurisdiction.

R103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the building official shall have the authority to appoint a deputy building official, ~~the other~~ related technical officers, inspectors, ~~plan examiners~~ and other employees. Such employees shall have powers as delegated by the building official.

Reason: There are many different names for the title of this section, but all include provisions for the creation of the code compliance agency. The department's responsibilities are more than just 'enforcement' of the code. The fill in the blank for the name allows for the agency to develop a name appropriate to their jurisdiction and responsibilities.

In some of the codes there will be a move from this section to *General Authority and responsibilities* section so that requirements for liability and legal defense will be in a consistent location.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

SECTION 103

CODE COMPLIANCE AGENCY

103.1 Creation of agency. The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the *code official*. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment. The *code official* shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the *code official* shall have the authority to appoint a deputy *code official*, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the *code official*.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech->

support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change with no change to construction requirements.

ADM16-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

Disapproved

Committee Reason: The committee likes the existing language, and doesn't like removing "plans examiner." We're taking a term out of the laundry list that seemed to work. The term "chief appointing authority" is confusing. We don't know who that is. If it is generic the legal authority of the state can resolve that issue. There could be a conflict with state and local laws outlying code enforcement and that could be confusing. Some jurisdictions already give this authority to other departments. (Vote: 9-2)

Assembly Action:

None

ADM16-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Submitted

Commenter's Reason: We are a family of codes. The building department will address residential and commercial, so the administration of these codes should be consistent. This terminology is used in many of the other codes, so it is not clear to us how to revise this proposal to address the items raised by the IRC committee. Addressing the committee comments:

- The phrase "chief appointing authority" proposed to be added in R103.2 is currently used in the IBC, IFC, IPC, IMC, IFGC, IEBC, ISPSC, IPMC, IPSDC, IWUIC (10 of 14 codes).
- The "plans examiner" is an employee, so it does not need to be in a laundry list. It was inconsistently listed in the other I-Codes, so ADM16 has proposed to delete it from the IBC, IRC, IEBC and ISPSC for consistency.
- Building departments have many different names. The intent of this section is to allow for a jurisdiction to insert their chosen name. This will

reduce conflicts and confusion “for state and local laws outlining code enforcement.”

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1204

NOTE: ADM16-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM16-19 Part I

IBC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3; IFC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3, [A] 104.7, [A] 104.7.1; IPC®: SECTION 103, 103.1, 103.2, 103.3, 104.8, 104.8.1; IMC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3, [A] 104.8, [A] 104.8.1; IFGC®: SECTION 103 (IFGC), [A] 103.1, [A] 103.2, [A] 103.3, [A] 104.8, [A] 104.8.1; IEBC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3; ISPSC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3, [A] 104.8, [A] 104.8.1; IPMC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3, [A] 104.7, [A] 104.7.1; IPSDC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3, [A] 104.7, [A] 104.7.1; IWUIC®: SECTION 103, [A] 103.1, [A] 103.2, [A] 103.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins (sehpcac@iccsafe.org)

THIS IS A 3 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. PART III WILL BE HEARD BY THE IgCC CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows:

SECTION 103 DEPARTMENT OF BUILDING SAFETY CODE COMPLIANCE AGENCY

[A] 103.1 Creation of enforcement agency. ~~The Department of Building Safety~~ ~~[INSERT NAME OF DEPARTMENT]~~ is hereby created and the official in charge thereof shall be known as the building official. ~~The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.~~

[A] 103.2 Appointment. The *building official* shall be appointed by the chief appointing authority of the jurisdiction.

[A] 103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the building official shall have the authority to appoint a deputy building official, ~~the other~~ related technical officers, inspectors, ~~plan examiners~~ and other employees. Such employees shall have powers as delegated by the building official. ~~For the maintenance of existing properties, see the International Property Maintenance Code.~~

2018 International Fire Code

Revise as follows:

SECTION 103 DEPARTMENT OF FIRE PREVENTION CODE COMPLIANCE AGENCY

[A] 103.1 General. Creation of agency. ~~The department of fire prevention is established within the jurisdiction under the direction of the fire code official.~~ ~~[INSERT NAME OF DEPARTMENT]~~ is hereby created and the official in charge thereof shall be known as the fire code official. ~~The function of the department agency shall be the implementation, administration and enforcement of the provisions of this code.~~

[A] 103.2 Appointment. The *fire code official* shall be appointed by the chief appointing authority of the jurisdiction. ~~and the fire code official shall not be removed from office except for cause and after full opportunity to be heard on specific and relevant charges by and before the appointing authority.~~

[A] 103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the fire code official shall have the authority to appoint a deputy fire code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the fire code official.

[A] ~~103.4~~ 104.7 Liability. The *fire code official*, member of the board of appeals, officer or employee charged with the enforcement of this code, while acting for the jurisdiction, in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of an act or by reason of an act or omission in the discharge of official duties.

[A] ~~103.4.1~~ 104.7.1 Legal defense. Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representatives of the

jurisdiction until the final termination of the proceedings. The *fire code official* or any subordinate shall not be liable for costs in an action, suit or proceeding that is instituted in pursuance of the provisions of this code; and any officer of the department of fire prevention, acting in good faith and without malice, shall be free from liability for acts performed under any of its provisions or by reason of any act or omission in the performance of official duties in connection therewith.

2018 International Plumbing Code

Revise as follows:

SECTION 103 DEPARTMENT OF PLUMBING INSPECTION CODE COMPLIANCE AGENCY

~~103.1~~ **General. Creation of agency.** The ~~department of plumbing inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment. The code official shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the code official.

~~103.4~~ **104.8 Liability.** The code official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

~~103.4.1~~ **104.8.1 Legal defense.** Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representative of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for costs in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

2018 International Mechanical Code

Revise as follows:

SECTION 103 DEPARTMENT OF MECHANICAL INSPECTION CODE COMPLIANCE AGENCY

[A] 103.1 General. Creation of agency. The ~~department of mechanical inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] 103.2 Appointment. The code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] 103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the code official.

[A] ~~103.4~~ 104.8 Liability. The code official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from personal liability for any damage accruing to persons or property as a result of an act or by reason of an act or omission in the discharge of official duties.

[A] ~~103.4.1~~ 104.8.1 Legal defense. Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representatives of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for costs in an action, suit or proceeding that is instituted in pursuance of the provisions of this code.

2018 International Fuel Gas Code

Revise as follows:

SECTION 103 (IFGC) DEPARTMENT OF INSPECTION CODE COMPLIANCE AGENCY

[A] 103.1 General. Creation of agency. The ~~Department of Inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~

official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] 103.2 Appointment. The code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] 103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the code official.

[A] ~~103.4~~ 104.8 Liability. The code official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of an act or by reason of an act or omission in the discharge of official duties.

[A] ~~103.4.1~~ 104.8.1 Legal defense. Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representatives of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for costs in an action, suit or proceeding that is instituted in pursuance of the provisions of this code.

2018 International Existing Building Code

Revise as follows:

SECTION 103 ~~DEPARTMENT OF BUILDING SAFETY CODE COMPLIANCE AGENCY~~

[A] 103.1 Creation of enforcement agency. The ~~Department of Building Safety~~ [INSERT NAME OF DEPARTMENT] is hereby created ~~and the official in charge in charge~~ thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] 103.2 Appointment. The *code official* shall be appointed by the chief appointing authority of the jurisdiction.

[A] 103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, ~~the other~~ related technical officers, inspectors ~~, plan examiners,~~ and other employees. Such employees shall have powers as delegated by the code official.

2018 International Swimming Pool and Spa Code

Revise as follows:

SECTION 103 ~~DEPARTMENT OF BUILDING SAFETY CODE COMPLIANCE AGENCY~~

[A] 103.1 Creation of enforcement agency. The ~~department of building safety~~ [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] 103.2 Appointment. The code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] 103.3 Deputies. In accordance with the prescribed procedures of ~~the this~~ jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, ~~the other~~ related technical officers, inspectors ~~, plans examiners~~ and other employees. Such employees shall have powers as delegated by the code official.

[A] ~~103.4~~ 104.8 Liability. The code official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

[A] ~~103.4.1~~ 104.8.1 Legal defenses. Any suit or criminal complaint instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representatives of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

2018 International Property Maintenance Code

Revise as follows:

SECTION 103
DEPARTMENT OF PROPERTY MAINTENANCE INSPECTION CODE COMPLIANCE AGENCY

[A] ~~103.1~~ **General: Creation of agency.** The department of property maintenance inspection ~~[INSERT NAME OF DEPARTMENT]~~ is hereby created and the executive official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] **103.2 Appointment.** The *code official* shall be appointed by the chief appointing authority of the jurisdiction.

[A] **103.3 Deputies.** In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy ~~(s): code official, other related technical officers, inspectors and other employees.~~ Such employees shall have powers as delegated by the code official.

[A] ~~103.4~~ **104.7 Liability.** The *code official*, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction, in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of an act or by reason of an act or omission in the discharge of official duties.

[A] ~~103.4.1~~ **104.7.1 Legal defense.** Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representative of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for costs in an action, suit or proceeding that is instituted in pursuance of the provisions of this code.

2018 International Private Sewage Disposal Code

Revise as follows:

SECTION 103
DEPARTMENT OF PRIVATE SEWAGE DISPOSAL INSPECTION CODE COMPLIANCE AGENCY

[A] ~~103.1~~ **General: Creation of agency.** The Department of Private Sewage Disposal Inspection ~~[INSERT NAME OF DEPARTMENT]~~ is hereby created and the executive official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] **103.2 Appointment.** The code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] **103.3 Deputies.** In accordance with the prescribed procedures of ~~the this~~ jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the code official.

[A] ~~103.4~~ **104.7 Liability.** The code official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

[A] ~~103.4.1~~ **104.7.1 Legal defense.** Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representatives of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for costs in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

2018 International Wildland-Urban Interface Code

Revise as follows:

SECTION 103
ENFORCEMENT CODE COMPLIANCE AGENCY

[A] **103.1 Creation of enforcement agency.** The department of ~~[INSERT NAME OF DEPARTMENT]~~ is hereby created and the official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] **103.2 Appointment.** The code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] **103.3 Deputies.** In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy ~~(s): deputy code official, other related technical officers, inspectors and other employees.~~ Such employees shall have powers as delegated by the code official.

Reason: There are many different names for the title of this section, but all include provisions for the creation of the code compliance agency. The department's responsibilities are more than just 'enforcement' of the code. The fill in the blank for the name allows for the agency to develop a name appropriate to their jurisdiction and responsibilities.

In some of the codes there will be a move from this section to *General Authority and responsibilities* section so that requirements for liability and legal defense will be in a consistent location.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

SECTION 103

CODE COMPLIANCE AGENCY

103.1 Creation of agency. The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the *code official*. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment. The *code official* shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the *code official* shall have the authority to appoint a deputy *code official*, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the *code official*.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is an editorial change with no change to construction requirements.

Public Hearing Results

Errata: This proposal includes unpublished errata
Instead of new text for Section 103.1, it should have been a revise as follows.

2018 International Building Code

Revise as follows:

[A] 103.1 Creation of enforcement agency. The ~~Department of Building Safety~~ [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the *building official*. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Fire Code

Section 103.1 is shown correctly.

2018 International Plumbing Code

Revise as follows:

[A] 103.1 General Creation of agency. The ~~department of plumbing inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Mechanical Code

Revise as follows:

[A] 103.1 General Creation of agency. The ~~department of mechanical inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Fuel Gas Code

Revise as follows:

[A] 103.1 General Creation of agency. The ~~department of inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Existing Building Code

Revise as follows:

[A] 103.1 Creation of enforcement agency. The ~~Department of Building Safety~~ [INSERT NAME OF DEPARTMENT] is hereby created, and the official in charge thereof shall be known as the *code official*. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Swimming Pool and Spa Code

Revise as follows:

[A] 103.1 Creation of enforcement agency. The ~~department of building safety~~ [INSERT NAME OF DEPARTMENT] is hereby created, and the official in charge thereof shall be known as the *code official*. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Property Maintenance Code

Revise as follows:

[A] ~~103.1 General Creation of agency.~~ The department of ~~property maintenance inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Private Sewage Disposal Code

Revise as follows:

[A] ~~103.1 General Creation of agency.~~ The Department of ~~Private Sewage Disposal Inspection~~ [INSERT NAME OF DEPARTMENT] is hereby created and the ~~executive~~ official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

2018 International Wildland-Urban Interface Code

Revise as follows:

[A] ~~103.1 Creation of enforcement agency.~~ The department of [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

Committee Action:

As Submitted

Committee Reason: The committee stated that the approval was based on the improvement to the consistency and ease of use from the standardization of the code compliance enforcement agency section and naming across the codes. (Vote: 13-0)

Assembly Action:

None

ADM16-19 Part I

NOTE: ADM16-19 PART III DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM16-19 Part III

IGCC@: 103 (New), 103.1 (New), 103.2 (New), 103.3 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Green Construction Code

Add new text as follows:

103 CODE COMPLIANCE AGENCY

103.1 Creation of agency The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the authority having jurisdiction (AHJ). The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment The authority having jurisdiction (AHJ) shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the authority having jurisdiction (AHJ) shall have the authority to appoint a deputy authority having jurisdiction (AHJ), other related technical officers, inspectors and other employees as shall be necessary. Such employees shall have powers as delegated by the authority having jurisdiction (AHJ).

Reason: There are many different names for the title of this section, but all include provisions for the creation of the code compliance agency. The department's responsibilities are more than just 'enforcement' of the code. The fill in the blank for the name allows for the agency to develop a name appropriate to their jurisdiction and responsibilities.

In some of the codes there will be a move from this section to *General Authority and responsibilities* section so that requirements for liability and legal defense will be in a consistent location.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

SECTION 103

CODE COMPLIANCE AGENCY

103.1 Creation of agency. The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment. The code official shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the code official.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change with no change to construction requirements.

ADM16-19 Part III

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

As Submitted

Committee Reason: This proposal provides consistency and correlation between codes. (Vote: 5-0)

Assembly Action:

None

ADM16-19 Part III

ADM19-19

IBC@: [A] 104.11 (New)

Proposed Change as Submitted

Proponents: Manny Muniz, Self, representing Self (Mannymuniz.mm@gmail.com)

2018 International Building Code

Delete and substitute as follows:

~~**[A] 104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.~~

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design meets all of the following:

1. The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of this code.
2. The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it pertains to the following:
 - 2.1. quality
 - 2.2. strength
 - 2.3. effectiveness
 - 2.4. fire resistance
 - 2.5. durability
 - 2.6. safety

Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

Reason: This section can be written more clearly as to the various criteria that must be met in order to be approved as an alternate material, design or method of construction. This will make it easier for the building official to make the necessary evaluation and decision. Should the alternate not be approved, it will also make it easier for the building official to cite the reasons for disapproval. There are no changes to the various requirements that the building official must consider.

Bibliography: No bibliography.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. There are no changes to the existing requirements.

ADM19-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
2018 International Building Code

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed ~~design~~ alternative meets all of the following:

1. The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of this code,
2. The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it pertains to the following:
 - 2.1 quality
 - 2.2 strength
 - 2.3 effectiveness
 - 2.4 fire resistance
 - 2.5 durability
 - 2.6 safety

Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

Committee Reason: The committee stated that the approval of the modification was based on the improvement to the language that makes it clear that it is the alternative that is subject to the list of requirements. The approval of the proposal was based on the proponent’s published reason.
(Vote: 13-0)

Assembly Action: **None**

ADM19-19

Individual Consideration Agenda

Public Comment 1:

IBC@: [A] 104.11 (New)

Proponents:

Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed alternative meets all of the following:

1. The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of this code,
2. The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it pertains to the following:
 - 2.1. quality
 - 2.2. strength
 - 2.3. effectiveness
 - 2.4. fire performance ~~resistance~~
 - 2.5. durability
 - 2.6. safety

Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why

the alternative was not approved.

Commenter's Reason: Fire resistance is defined in the IBC as "That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use." Therefore, the term is being misused in this application.

In this location the intent is that the alternative material or product or design performs at least as well with respect to fire as the one covered by the code.

Therefore, the appropriate term to use is not fire resistance but fire performance. Fire performance is used in multiple locations in Chapter 8 of the IBC and is also used in other codes, such as the IFC, IRC and IEBC. The concept of fire performance is broader than the concept of fire resistance because it encompasses both reaction to fire (i.e. what the material, product or assembly generates in a fire) and fire resistance (which, as described above, refers to how a product or assembly protects against the passage of heat or flames).

The intent of the section modified by the proposal is to look at the concept of fire performance (however it applies for any individual case) and not simply at the more limited concept of fire resistance. Thus, the only change proposed by this public comment is to use the correct terminology.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment corrects the code to use the proper terminology.

Public Comment# 1403

Public Comment 2:

IBC®: [A] 104.11 (New)

Proponents:

James Smith, American Wood Council, representing American Wood Council (jsmith@awc.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that ~~the proposed alternative meets all of the following:~~

1. ~~The alternative material, the proposed design or method of construction~~ is satisfactory and complies with the intent of the provisions of this code, and
2. ~~The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it~~ pertains to the following in:
 - ~~2.1-~~ quality₁
 - ~~2.2-~~ strength₁
 - ~~2.3-~~ effectiveness₁
 - ~~2.4-~~ fire resistance₁
 - ~~2.5-~~ durability₁ and
 - ~~2.6-~~ safety₁

Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

Commenter's Reason: The Committee approval of the revised language in 104.11 was based upon, in part, the proposal's reason statement that there are no changes to the various requirements that the building official must consider. However, the specific association between "the proposed design" and complying with the intent of the provisions of the code has been changed. Section 104.11 Item 1 of the Committee's recommendation for approval includes the original proponent's wording that the alternative material and method of construction complies with the intent of the provisions of the code. We think this wording change could cause confusion for approval of materials and methods of construction that are fully intended to be

alternatives to those materials and methods of construction that are explicitly prescribed in the code.

The further modifications we are proposing to the Committee's "Approved as Modified" version implement changes that restores original wording of 104.11 while keeping the enumerated list of requirements. These specific additional modifications to restore the original wording while keeping the enumerated list are as follows:

104.11 last sentence before the enumerated list: "the proposed alternative meets all of the following" is deleted because it is not part of the current 104.11.

104.11 item 1: "The alternative material" and "or method of construction" is deleted because it is not part of the current 104.11 sentence associating design with intent of the code. "the proposed" and "and" is added to restore the current text of 104.11.

104.11 Item 2: "as it pertains to the following" is deleted because it is not part of the current 104.11. "in" is added to restore the current text of 104.11.

104.11 Item 2.1 through 2.5: commas and "and" is added to restore the current text of 104.11.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

We feel that the further modifications in this public comment are editorial in nature and will only make the language clearer for the code officials being called upon to approve alternatives.

Public Comment# 1949

ADM20-19

IBC@: [A] 104.11 (New)

Proposed Change as Submitted

Proponents: Manny Muniz, representing Self (Mannymuniz.mm@gmail.com)

2018 International Building Code

Revise as follows:

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety. Approval of an alternate material, design or method of construction shall be issued in writing demonstrating evaluation of all the criteria stated in this section. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Reason: Just as written documentation is required for not approving an alternate, written documentation should also be required when the alternate is approved to show that the building official has determined that the alternate meets all of the criteria of 104.11.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This has no impact on the cost of construction.

ADM20-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reason for disapproval was that when an alternative is approved it is not necessary to document the reasons and that it would put an unnecessary burden on the code official to comply with the requirement. (Vote: 13-0)

Assembly Action:

None

ADM20-19

Individual Consideration Agenda

Public Comment 1:

IBC@: [A] 104.11

Proponents:

Manny Muniz, representing Representing self (mannymuniz.mm@gmail.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety.

Approval of an alternate material, design or method of construction shall be documented. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Commenter's Reason: Just as written documentation is required for not approving an alternate, approving an alternate should also be documented to explain why specifically prescribed provisions of the code were not followed. This will help should it become necessary to perform a forensic examination of a structure.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Will not increase or decrease cost of construction. This is a clarification of the requirements.

Public Comment# 1864

ADM21-19

IBC@: [A] 104.11

Proposed Change as Submitted

Proponents: Manny Muniz, representing Self (Mannymuniz.mm@gmail.com)

2018 International Building Code

Revise as follows:

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety. Such approval shall be limited to a specific project. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Reason: Alternates should be limited to a specific project in order to encourage the use of ICC-ES Acceptance Criteria or a formal code change so an alternate is not used in perpetuity, thus avoiding closer scrutiny. This will not prevent the building official from approving an alternate for future projects but provides a method for limiting them.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change does not prevent the building official from approving an alternate for any number of projects.

ADM21-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the disapproval was based on the existing section already having the intent of being about a specific project and it also having the flexibility of allowing the code official to make a blanket approval. (Vote: 13-0)

Assembly Action:

None

ADM21-19

Individual Consideration Agenda

Public Comment 1:

IBC@: [A] 104.11

Proponents:

Manny Muniz, representing Representing self (mannymuniz.mm@gmail.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety.

Such approval shall not establish precedence for future projects. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Commenter's Reason: Alternates should be limited in order to encourage the use of ICC-ES Acceptance Criteria or a formal code change, so an alternate is not used in perpetuity, thus avoiding closer scrutiny. This will not prevent the building official from approving an alternate for future projects but provides a method for limiting them. The modified language addresses the committees concerns

Bibliography: No bibliography

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This will not increase or decrease the cost of construction. This is a clarification of the requirements.

Public Comment# 1871

ADM22-19

IBC@: [A] 104.11.2

Proposed Change as Submitted

Proponents: Manny Muniz, representing Self (Mannymuniz.mm@gmail.com)

2018 International Building Code

[A] 104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made without expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. Test samples shall be randomly selected by an approved agency. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved agency*. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

Reason: When the building official requires a test as evidence of compliance, it is important that the test samples be randomly selected by an approved agency so the agency knows what they are testing. This is similar to what test agencies do when testing a product that is to be listed. Unless otherwise instructed, test agencies will perform developmental tests on test samples submitted to them. Such developmental tests are not suitable for listing purposes nor are they suitable for tests required by this section.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The cost of construction will not be affected by the verification of legitimate test samples.

ADM22-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reasons for disapproval were as follows: the testing agency already has the authority to perform as many test as necessary, the proposal does not specify who is responsible for requiring the random test samples and that the tests would be for only one assembly. (Vote: 13-0)

Assembly Action:

None

ADM22-19

Individual Consideration Agenda

Public Comment MUNIZ-1:

IBC@: [A] 104.11.2

Proponents:

Manny Muniz, representing Representing self (mannymuniz.mm@gmail.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

[A] 104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made without expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved agency that will randomly select test samples.* Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

Commenter's Reason: When the building official requires a test of an alternate material as evidence of compliance, it may be necessary to have the test samples randomly selected by an approved agency to verify what is being testing. This is similar to what test agencies do when testing a product that is to be listed. Approved testing agencies must have some certainty as to what it is they are testing and so they must choose the samples to be tested. The modified language addresses the concerns of the committee.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Will not increase or decrease cost of construction. This is a clarification of the requirements.

Public Comment# 1874

ADM23-19 Part I

IBC®: [A] 104.11, [A] 104.11.1, 104.11.1.1 (New), [A] 104.11.2, 107.3.1.1 (New), 202 (New)

Proposed Change as Submitted

Proponents: Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IBC-STRUCTURAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEES.

2018 International Building Code

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

[A] 104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

Add new text as follows:

104.11.1.1 Approved sources. Agencies conducting product certification or product evaluation shall be accredited by an *accreditation body*. For the research report to be accepted for product approval, the scope of accreditation shall include the acceptance criteria referenced in the research report.

[A] 104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made without expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved agency*. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

Add new text as follows:

107.3.1.1 Third-party certification. Products and materials required by the code to be in compliance with referenced standards shall be *certified by a third-party certification agency as complying with the referenced standards*. Products and materials shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

Add new definition as follows:

THIRD-PARTY CERTIFICATION AGENCY. An *approved agency* operating a product or material certification system that incorporates initial product testing, assessment and surveillance of a manufacturer's quality control system.

Reason: The standard practice in building products conformity assessment involves accreditation of the agencies by an accreditation body such as ISO. Third party testing, manufacturing inspections and product certification or product evaluation provide a higher level of quality assurance on these activities for the building official. Approved sources that issue research reports must be accredited to the specific acceptance criteria referenced in the research report. This ensures that the approved sources have the requisite technical expertise and experience to conduct such activities on behalf of the building official. Harmonized language is proposed for inclusion in a new Section 107.3.1.1 regarding third-party certification, and in Chapter 2 with a definition for third-party certification agency. The language in the new Section 107.3.1.1 is identical to language in the International Plumbing Code Section 303.4. The added definition is the same as that in the International Residential Code, International Plumbing Code and International Mechanical Code. The revised definition for Accreditation Body is necessary as it applies to product certification and inspection activities for building products and materials in general, and not lumber mills specifically. These additions will improve the consistency and intent of the I-codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal provides clarification and consistency.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reason for disapproval was that the provision of the original proposal is far too limiting on code officials and does not give credit to alternative agencies or individuals with expertise on certain products or methods. (Vote: 13-0)

Assembly Action:

None

ADM23-19 Part I

Individual Consideration Agenda

Public Comment 1:

IBC®: 104.11.1.1 (New)

Proponents:

Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

104.11.1.1 Approved sources for product certification or product evaluation. Product certification and product evaluations shall be performed by agencies that are accredited by an accreditation body or shall be performed by registered design professionals. The scope of accreditation shall include the standard or acceptance criteria referenced in the research report, for the research report to be accepted for product approval.

Commenter's Reason: Comments were received that the section "Approved Sources" conflicts with the definition of "Approved Source" elsewhere in the code. The section title was revised and clarified to pertain specifically to agencies conducting product certification and product evaluation. Comments were received that in some cases, registered design professionals may already do product certification or product evaluation for certain types of building products. The text was revised to include registered design professionals.

Comments were received that the term "acceptance criteria" was limiting. This is not the case, as the term "acceptance criteria" already appears many times throughout the code, and the meaning is well understood. "Standards" were added alongside "acceptance criteria", as research reports may be based on standards or acceptance criteria.

Comments were received that requiring third-party certification by third-party certification agencies would create an undue burden and was not necessary for all building products in the code. The third-party certification requirement and definition of third-party certification agency are consequently deleted.

For the reasons above, we strongly encourage overturning the committee and approving the code change as modified by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment removes the requirement for third party certification.

Public Comment# 1467

ADM23-19 Part II

IBC®: [BS] 202

Proposed Change as Submitted

Proponents: Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

2018 International Building Code

Revise as follows:

[BS] ACCREDITATION BODY. An *approved*, third-party organization that is independent of the grading, product certification and inspection agencies, ~~and the lumber mills,~~ and that initially accredits and subsequently monitors agencies conducting building product certification or evaluation schemes, on a continuing basis, including the competency and performance of a grading or inspection agency related to carrying out specific tasks.

ADM23-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns that the definition provided was unclear and the action was consistent with the action on Part I (disapproved).

(Vote: 14-0)

Assembly Action:

None

ADM23-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

requests As Submitted

Commenter's Reason: Comments were received that the proposed modifications to the definition of "Accreditation Body" were unclear. The definition already exists in the code and is well understood. The proposed code change to the definition clarifies the definition and makes it more general pertaining to building product certification or product evaluation.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment requests As Submitted. The cost impact statement on the original proposal notes no increase or decrease in cost of construction. The original proposal provides clarification and consistency.

Public Comment# 1468

ADM24-19 Part I

IBC@: [A] 105.2 (New)

Proposed Change as Submitted

Proponents: Marc Levitan, representing the ICC 500 Development Committee; Pataya Scott, representing Federal Emergency Management Agency (pataya.scott@fema.dhs.gov); Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows:

[A] 105.2 Work exempt from permit. Exemptions from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. *Permits* shall not be required for the following:

Building:

1. ~~One-story~~ Other than storm shelters, one-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided that the floor area is not greater than 120 square feet (11 m²).
2. Fences not over 7 feet (2134 mm) high.
3. Oil derricks.
4. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or IIIA liquids.
5. Water tanks supported directly on grade if the capacity is not greater than 5,000 gallons (18 925 L) and the ratio of height to diameter or width is not greater than 2:1.
6. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade, and not over any basement or *story* below and are not part of an *accessible route*.
7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
8. Temporary motion picture, television and theater stage sets and scenery.
9. Prefabricated *swimming pools* accessory to a Group R-3 occupancy that are less than 24 inches (610 mm) deep, are not greater than 5,000 gallons (18 925 L) and are installed entirely above ground.
10. Shade cloth structures constructed for nursery or agricultural purposes, not including service systems.
11. Swings and other playground equipment accessory to detached one- and two-family *dwellings*.
12. Window awnings in Group R-3 and U occupancies, supported by an exterior wall that do not project more than 54 inches (1372 mm) from the *exterior wall* and do not require additional support.
13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

Electrical:

1. **Repairs and maintenance:** Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical equipment to *approved* permanently installed receptacles.
2. **Radio and television transmitting stations:** The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for a power supply and the installations of towers and antennas.
3. **Temporary testing systems:** A *permit* shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.

Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (4.54 kg) or less of refrigerant and actuated by motors of 1 horsepower (0.75 kW) or less.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe, provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided that such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

Reason: The list of 'Work exempted from permit' in the IBC includes detached accessory structures not greater than 120 square feet; the IRC exempts the same detached accessory structures, but sets the area threshold at 200 square feet. Some detached storm shelters – especially prefabricated units – may be smaller than 120 (or 200) square feet, and classified as accessory structures in accordance with administrative provisions described above. It should also be noted that storm shelters may serve as multi-function buildings such as garden sheds (residential) and light storage (residential and commercial). However, unlike other accessory structures where function is incidental, the storm shelter's primary function is to provide life safety protection from extreme wind events. As such, storm shelter construction and installation should always require a building permit to provide quality assurance for the life safety protection of all potential storm shelter occupants. Non-permitted storm shelter installation is unfortunately common for residential prefabricated models which are frequently installed after the residential building has been occupied. Some Midwestern jurisdictions only permit storm shelters when they are installed under FEMA-sponsored rebate programs, but all storm shelters should provide consumers with the same level of life safety protection and associated security. Unpermitted prefabricated shelters are most vulnerable to inadequate anchorage because in most cases proper installation is not verified through an independent field inspection. For above ground storm shelters, the existing slab must meet manufacturer's minimum requirements to resist uplift and overturning during an extreme wind event. Accordingly, ICC 500 Section 106.3.1 requires special inspection to verify 1) the capacity of anchors that are post-installed in hardened concrete and 2) the adequacy of the existing slab to meet specifications provided by the manufacturer. For in-ground storm shelters, inadequate anchorage can result in shelters being dislodged when groundwater rises around them.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC 500 Storm Shelter Standard Development committee.

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The ICC 500 Standards Development committee is responsible for the development of the ICC/NSSA Standard for the Design and Construction of Storm Shelters. The committee is currently working on the development of the 2020 edition. In 2017 the ICC 500 committee held 7 open conference calls. In addition, there were numerous Working Group meetings and conference calls, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/standards-development/is-stm>.

Cost Impact: The code change proposal will increase the cost of construction. Increases the cost for installing storm shelters by the cost of the permit fee, but only in jurisdictions that currently allow installation without permits.

ADM24-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reason for disapproval was that the proposed language was adding an exception to an exception and that storm shelters are not similar to the other structures that are listed in the section. Additionally there was disagreement over the need and use for the definitions to determine if the requirements apply. (Vote: 13-0)

Assembly Action:

None

ADM24-19 Part I

Individual Consideration Agenda

Public Comment 1:

IBC@: [A] 105.2 (New)

Proponents:

Ed Kulik, representing Building Code Action Committee (bcac@iccsafe.org); Pataya Scott, representing FEMA (pataya.scott@fema.dhs.gov); Benchmark Harris, representing National Storm Shelter Association (bharris@huckabee-inc.com); Marc Levitan, representing ICC 500 Standard Development Committee (marc.levitan@nist.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

[A] 105.2 Work exempt from permit. Exemptions from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. *Permits* shall not be required for the following:

Building:

1. ~~Other than storm shelters, one-story~~ One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided that the floor area is not greater than 120 square feet (11 m²). This exemption does not apply to storm shelters.
2. Fences not over 7 feet (2134 mm) high.
3. Oil derricks.
4. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or IIIA liquids.
5. Water tanks supported directly on grade if the capacity is not greater than 5,000 gallons (18 925 L) and the ratio of height to diameter or width is not greater than 2:1.
6. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade, and not over any basement or *story* below and are not part of an *accessible route*.
7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
8. Temporary motion picture, television and theater stage sets and scenery.
9. Prefabricated *swimming pools* accessory to a Group R-3 occupancy that are less than 24 inches (610 mm) deep, are not greater than 5,000 gallons (18 925 L) and are installed entirely above ground.
10. Shade cloth structures constructed for nursery or agricultural purposes, not including service systems.
11. Swings and other playground equipment accessory to detached one- and two-family *dwellings*.
12. Window awnings in Group R-3 and U occupancies, supported by an exterior wall that do not project more than 54 inches (1372 mm) from the *exterior wall* and do not require additional support.
13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

Electrical:

1. **Repairs and maintenance:** Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical equipment to *approved* permanently installed receptacles.
2. **Radio and television transmitting stations:** The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for a power supply and the installations of towers and antennas.
3. **Temporary testing systems:** A *permit* shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.

Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (4.54 kg) or less of refrigerant and actuated by motors of 1 horsepower (0.75 kW) or less.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe, provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided that such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

Commenter's Reason: The modification is only editorial and intended to address the committee's concern on grammar. Requiring permits for storm shelters is an important safety consideration.

This requirement for small residential storm shelters to have building permits was successful in the IRC. Residential storm shelter (16 or fewer occupants) can be installed serving Group R-3 and R-4 homes and townhouses that fall in the IBC, so this is applicable to the IBC and the IRC. All storm shelters need to have a building permit to ensure they meet safety requirements and so emergency responders know where they are. Storm shelters can serve other purposes when not needed, so they would be 'accessory' by being under 120 sq.ft., and used as storage sheds, playhouses or similar uses. This is needed to prevent 'home built' storm shelters that do not meet minimum safety requirements to protect a family during a storm.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Increases the cost for installing storm shelters by the cost of the permit fee, but only in jurisdictions that currently allow installation without permits.

NOTE: ADM24-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM24-19 Part II

IRC@: R105.2 (New)

Proposed Change as Submitted

Proponents: Marc Levitan, representing the ICC 500 Development Committee; Pataya Scott, representing Federal Emergency Management Agency (pataya.scott@fema.dhs.gov); Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

R105.2 Work exempt from permit. Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*. *Permits* shall not be required for the following:

Building:

1. ~~One-~~Other than storm shelters, one-story detached *accessory structures*, provided that the floor area does not exceed 200 square feet (18.58 m²).
2. Fences not over 7 feet (2134 mm) high.
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
5. Sidewalks and driveways.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Prefabricated swimming pools that are less than 24 inches (610 mm) deep.
8. Swings and other playground equipment.
9. Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
10. Decks not exceeding 200 square feet (18.58 m²) in area, that are not more than 30 inches (762 mm) above *grade* at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.

Electrical:

1. *Listed* cord-and-plug connected temporary decorative lighting.
2. Reinstallation of attachment plug receptacles but not the outlets therefor.
3. Replacement of branch circuit overcurrent devices of the required capacity in the same location.
4. Electrical wiring, devices, *appliances*, apparatus or *equipment* operating at less than 25 volts and not capable of supplying more than 50 watts of energy.
5. Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical *equipment* to *approved* permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying *appliances*.
2. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
3. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Mechanical:

1. Portable heating *appliances*.
2. Portable ventilation *appliances*.
3. Portable cooling units.
4. Steam, hot- or chilled-water piping within any heating or cooling *equipment* regulated by this code.
5. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
6. Portable evaporative coolers.
7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.
8. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

Reason: The list of 'Work exempted from permit' in the IBC includes detached accessory structures not greater than 120 square feet; the IRC exempts the same detached accessory structures, but sets the area threshold at 200 square feet. Some detached storm shelters – especially prefabricated units – may be smaller than 120 (or 200) square feet, and classified as accessory structures in accordance with administrative provisions described above. It should also be noted that storm shelters may serve as multi-function buildings such as garden sheds (residential) and light storage (residential and commercial). However, unlike other accessory structures where function is incidental, the storm shelter's primary function is to provide life safety protection from extreme wind events. As such, storm shelter construction and installation should always require a building permit to provide quality assurance for the life safety protection of all potential storm shelter occupants.

Non-permitted storm shelter installation is unfortunately common for residential prefabricated models which are frequently installed after the residential building has been occupied. Some Midwestern jurisdictions only permit storm shelters when they are installed under FEMA-sponsored rebate programs, but all storm shelters should provide consumers with the same level of life safety protection and associated security. Unpermitted prefabricated shelters are most vulnerable to inadequate anchorage because in most cases proper installation is not verified through an independent field inspection. For above ground storm shelters, the existing slab must meet manufacturer's minimum requirements to resist uplift and overturning during an extreme wind event. Accordingly, ICC 500 Section 106.3.1 requires special inspection to verify 1) the capacity of anchors that are post-installed in hardened concrete and 2) the adequacy of the existing slab to meet specifications provided by the manufacturer. For in-ground storm shelters, inadequate anchorage can result in shelters being dislodged when groundwater rises around them.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC 500 Storm Shelter Standard Development committee.

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The ICC 500 Standards Development committee is responsible for the development of the ICC/NSSA Standard for the Design and Construction of Storm Shelters. The committee is currently working on the development of the 2020 edition. In 2017 the ICC 500 committee held 7 open conference calls. In addition, there were numerous Working Group meetings and conference calls, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/standards-development/is-stm>.

Cost Impact: The code change proposal will increase the cost of construction
Increases the cost for installing storm shelters by the cost of the permit fee, but only in jurisdictions that currently allow installation without permits.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: It seems reasonable to require a permit for storm shelters, though the embedded exception is awkward. (Vote: 6-4)

Assembly Action:

None

ADM24-19 Part II

ADM32-19 Part I

IBC®: SECTION 108, [A] 108.1, [A] 108.2, [A] 108.3, [A] 108.4; IPC®: SECTION 110, 110.1, 110.2, 110.3, 110.4; IMC®: SECTION 110, [A] 110.1, [A] 110.2, [A] 110.3, [A] 110.4; IFGC®: SECTION 110 (IFGC), [A] 110.1, [A] 110.2, [A] 110.3, [A] 110.4; IEBC®: SECTION 107, [A] 107.1, [A] 107.2, [A] 107.3, [A] 107.4; IPSDC®: SECTION 110, [A] 110.1, [A] 110.2, [A] 110.3, [A] 110.4; IWUIC®: SECTION 112, [A] 112.1, [A] 112.2, 112.3, [A] 112.4; ISPSC®: SECTION 106, 106.1, 106.2, 106.3, 106.4

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, FCAC, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEES.

2018 International Building Code

Revise as follows:

SECTION 108 TEMPORARY USES, EQUIPMENT AND STRUCTURES ~~AND USES~~

[A] 108.1 General. The *building official* is authorized to issue a permit for temporary ~~structures and temporary uses~~, structures, uses, equipment or systems. Such *permits* shall be limited as to time of service, but shall not be permitted for more than 180 days. The *building official* is authorized to grant extensions for demonstrated cause.

[A] 108.2 Conformance. Temporary ~~structures uses and uses shall~~ structures shall comply with the requirements in Section 3103.

[A] 108.3 Temporary power. The *building official* is authorized to give permission to temporarily supply ~~and use power in part of an electric installation before such installation~~ utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final certificate of completion approval has been issued. The part covered by the temporary ~~certificate approval~~ shall comply with the requirements specified for temporary lighting, heat or power in ~~NFPA 70: this code~~.

[A] 108.4 Termination of approval. The *building official* is authorized to terminate such permit for a temporary ~~structure uses equipment, or use system and to order the temporary structure or use same~~ structure uses equipment, or use system and to order the ~~temporary structure or use same~~ to be discontinued.

2018 International Plumbing Code

Revise as follows:

SECTION 110 TEMPORARY USES, EQUIPMENT, AND SYSTEMS ~~AND USES~~

110.1 General. The code official is authorized to issue a permit for temporary uses, equipment, systems and uses, ~~or systems~~. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

110.2 Conformance. Temporary uses, equipment, and systems ~~and uses~~ shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the ~~public~~ health, safety and general welfare.

110.3 Temporary utilities. The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final ~~certificate of completion approval~~ has been issued. The part covered by the temporary ~~certificate approval~~ shall comply with the requirements specified for temporary lighting, heat or power in ~~the this code~~.

110.4 Termination of approval. The code official is authorized to terminate such permit for temporary uses, equipment, systems or uses ~~system~~ and to order the ~~temporary equipment, systems or uses same~~ to be discontinued.

2018 International Mechanical Code

Revise as follows:

SECTION 110 TEMPORARY USES, EQUIPMENT, AND SYSTEMS ~~AND USES~~

[A] 110.1 General. The code official is authorized to issue a permit for temporary uses, equipment, systems and uses, ~~or systems~~. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 110.2 **Conformance.** Temporary uses, equipment, and systems ~~and uses~~ shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the ~~public~~ health, safety and general welfare.

[A] 110.3 **Temporary utilities.** The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final ~~certificate of completion approval~~ has been issued. The part covered by the temporary ~~certificate approval~~ shall comply with the requirements specified for temporary lighting, heat or power in ~~the~~ this code.

[A] 110.4 **Termination of approval.** The code official is authorized to terminate such permit for temporary uses, equipment, systems or uses ~~system~~ and to order the ~~temporary equipment, systems or uses same~~ to be discontinued.

2018 International Fuel Gas Code

Revise as follows:

SECTION 110 (IFGC) TEMPORARY USES, EQUIPMENT, AND SYSTEMS ~~AND USES~~

[A] 110.1 **General.** The code official is authorized to issue a permit for temporary uses, equipment, systems and uses ~~or systems~~. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 110.2 **Conformance.** Temporary uses, equipment, and systems ~~and uses~~ shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the ~~public~~ health, safety and general welfare.

[A] 110.3 **Temporary utilities.** The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final ~~certificate of completion approval~~ has been issued. The part covered by the temporary ~~certificate approval~~ shall comply with the requirements specified for temporary lighting, heat or power in ~~the~~ this code.

[A] 110.4 **Termination of approval.** The code official is authorized to terminate such permit for ~~a temporary structure uses equipment, or use system~~ and to order the ~~temporary structure or use same~~ to be discontinued.

2018 International Existing Building Code

Revise as follows:

SECTION 107 TEMPORARY STRUCTURES AND USES ~~USES, EQUIPMENT, AND SYSTEMS~~

[A] 107.1 **General.** The code official is authorized to issue a permit for temporary ~~uses, equipment, or systems~~. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 107.2 **Conformance.** Temporary uses, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the ~~public~~ health, safety and general welfare.

[A] 107.3 **Temporary power.** The code official is authorized to give permission to temporarily supply ~~and use power in part of an electric installation before such installation~~ utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final ~~certificate of completion approval~~ has been issued. The part covered by the temporary ~~certificate approval~~ shall comply with the requirements specified for temporary lighting, heat or power in ~~NFPA 70: this code~~.

[A] 107.4 **Termination of approval.** The code official is authorized to terminate such permit for ~~a temporary use uses equipment, or system~~ and to order the ~~temporary use same~~ to be discontinued.

2018 International Private Sewage Disposal Code

Revise as follows:

SECTION 110 TEMPORARY USES, EQUIPMENT, AND SYSTEMS ~~AND USES~~

[A] 110.1 **General.** The code official is authorized to issue a permit for temporary uses, equipment, systems and uses ~~or systems~~. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 110.2 **Conformance.** Temporary uses, equipment, and systems ~~and uses~~ shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the ~~public~~ health, safety and general welfare.

[A] 110.3 **Temporary utilities.** The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water

~~systems or sewer systems before an installation has been fully completed and the final certificate of completion approval has been issued. The part covered by the temporary certificate approval shall comply with the requirements specified for temporary lighting, heat or power in the this code.~~

~~[A] 110.4 Termination of approval. The code official is authorized to terminate such permit for a temporary structure uses equipment, or use system and to order the temporary structure or use same to be discontinued.~~

2018 International Wildland-Urban Interface Code

Revise as follows:

SECTION 112 **TEMPORARY STRUCTURES AND USES USES, EQUIPMENT, AND SYSTEMS**

~~[A] 112.1 General. The code official is authorized to issue a permit for temporary structures and temporary uses uses, equipment, or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.~~

~~[A] 112.2 Conformance. Temporary structures and uses equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the public health, safety and general welfare.~~

~~112.3 Temporary utilities. The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.~~

~~[A] 112.3 112.4 Termination of approval. The code official is authorized to terminate such permit for a temporary structure uses equipment, or use system and to order the temporary structure or use same to be discontinued.~~

2018 International Swimming Pool and Spa Code

Revise as follows:

SECTION 106 **TEMPORARY USES, EQUIPMENT, AND SYSTEMS**

~~106.1 General. The code official is authorized to issue a permit for temporary uses, equipment, or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.~~

~~106.2 Conformance. Temporary uses, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.~~

~~106.3 Temporary utilities. The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.~~

~~106.4 Termination of approval. The code official is authorized to terminate such permit for temporary uses equipment, or system and to order the same to be discontinued.~~

Reason: The purpose of this proposal is coordination between codes for the section on temporary structures. The word use is moved to the front. The allowances for temporary connection under inspection and testing address more than just utilities, so the language in this section should match. The phrase "certificate of completion" is not defined, so "approved" would be a better choice.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

IBC

SECTION 108

TEMPORARY USES, EQUIPMENT, AND SYSTEMS

[A] 108.1 General. The building official is authorized to issue a permit for temporary uses, equipment, or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

[A] 108.2 Conformance. Temporary uses, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.

[A] 108.3 Temporary utilities. The building official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

[A] 108.4 Termination of approval. The building official is authorized to terminate such permit for temporary uses equipment, or system and to order the same to be discontinued.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM32-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reason for disapproval was that it is not all inclusive as the intent is and only goes half way. Additionally it was stated that it should include the IFC. (Vote: 10-3)

Assembly Action:

None

ADM32-19 Part I

Individual Consideration Agenda

Public Comment 1:

IBC®: SECTION 108, [A] 108.1, [A] 108.2, [A] 108.3, [A] 108.4; IEBC®: SECTION 107, [A] 107.1, [A] 107.2, [A] 107.3, [A] 107.4; IWUIC®: SECTION 112, [A] 112.1, [A] 112.2, 112.3, [A] 112.4; ISpsc®: SECTION 106, 106.1, 106.2, 106.3, 106.4; IFC®: SECTION 106 (New), 106.1

(New), 106.2 (New), 106.3 (New), 106.4 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

SECTION 108 TEMPORARY USES, STRUCTURES, EQUIPMENT AND STRUCTURES-SYSTEMS

[A] 108.1 **General.** The *building official* is authorized to issue a permit for temporary uses, structures, uses, equipment or systems. Such *permits* shall be limited as to time of service, but shall not be permitted for more than 180 days. The *building official* is authorized to grant extensions for demonstrated cause.

[A] 108.2 **Conformance.** Temporary uses and structures shall comply with the requirements in Section 3103.

[A] 108.3 **Temporary power.** The *building official* is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

[A] 108.4 **Termination of approval.** The *building official* is authorized to terminate such permit for temporary uses, structures, equipment, or system and to order the same to be discontinued.

2018 International Existing Building Code

SECTION 107 TEMPORARY USES, STRUCTURES, EQUIPMENT, AND SYSTEMS

[A] 107.1 **General.** The code official is authorized to issue a permit for temporary uses, structures, equipment, or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 107.2 **Conformance.** Temporary uses, structures, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.

[A] 107.3 **Temporary power.** The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

[A] 107.4 **Termination of approval.** The code official is authorized to terminate such permit for temporary uses, structures, equipment, or system and to order the same to be discontinued.

2018 International Wildland-Urban Interface Code

SECTION 112 TEMPORARY USES, STRUCTURES, EQUIPMENT, AND SYSTEMS

[A] 112.1 **General.** The code official is authorized to issue a permit for temporary uses, structures, equipment, or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 112.2 **Conformance.** Temporary uses, structures, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.

112.3 **Temporary utilities.** The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

[A] 112.4 **Termination of approval.** The code official is authorized to terminate such permit for temporary uses, structures, equipment, or system and to order the same to be discontinued.

2018 International Swimming Pool and Spa Code

SECTION 106 TEMPORARY USES, STRUCTURES, EQUIPMENT, AND SYSTEMS

106.1 General. The code official is authorized to issue a permit for temporary uses, structures, equipment, or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

106.2 Conformance. Temporary uses, structures, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.

106.3 Temporary utilities. The code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

106.4 Termination of approval. The code official is authorized to terminate such permit for temporary uses, structures, equipment, or system and to order the same to be discontinued.

2018 International Fire Code

SECTION 106 TEMPORARY USES, STRUCTURES, EQUIPMENT AND SYSTEMS

106.1 General. The fire code official is authorized to issue a permit for temporary uses, structures, equipment or systems. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The fire code official is authorized to grant extensions for demonstrated cause.

106.2 Conformance Temporary uses, equipment, and systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.

106.3 Temporary power. The fire code official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

106.4 Termination of approval. The fire code official is authorized to terminate such permit for a temporary uses, structures, equipment, or system and to order the same to be discontinued.

Commenter's Reason: During the code change hearings, no one spoke against this proposal. The original proposal modified the section for temporary facilities where it was already in the code with the exception of ISFSC. The committee felt that it was very important to add these safety options to the IFC as well, so this modification adds this to IFC. As requested by the committee, the BCAC worked with FCAC and PMGCAC to develop this public comment.

When looking for coordination, some of the codes did not include 'structure' and some did. The residential committee felt it was important to keep 'structures', so to be consistent, we are asking for a modification for codes that include structures, which includes, IBC, IEBC, IWUIC, ISFSC and IFC. This is mostly putting it back where it was in current text.

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-techsupport/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-techsupport/cs/fire-code-action-committee-fcac/>

The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

ADM32-19 Part II

IRC@: SECTION R107, R107.1, R107.2, R107.3, R107.4

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, FCAC, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R107 TEMPORARY STRUCTURES-USES, EQUIPMENT AND USES STRUCTURES

R107.1 General. The *building official* is authorized to issue a permit for temporary ~~structures and temporary uses~~ uses, equipment, or systems. Such *permits* shall be limited as to time of service, but shall not be permitted for more than 180 days. The *building official* is authorized to grant extensions for demonstrated cause.

R107.2 Conformance. Temporary ~~structures and uses~~ shall uses, structures, equipment or systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure ~~the public~~ the health, safety and general welfare.

R107.3 Temporary power. The building official is authorized to give permission to temporarily supply ~~and use power in part of an electric installation before such installation~~ utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final certificate of completion approval has been issued. The part covered by the temporary ~~certificate approval~~ shall comply with the requirements specified for temporary lighting, heat or power in NFPA-70: this code.

R107.4 Termination of approval. The building official is authorized to terminate such permit for ~~a temporary structure uses equipment, or use system~~ and to order the temporary structure or use same to be discontinued.

ADM32-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The term "structures" is used in Section R107.2 in the laundry list and this is not consistent. The term is not used in the general scoping provisions of Section R107.1. (Vote: 10-1)

Assembly Action:

None

ADM32-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC@: SECTION R107, R107.1, R107.2, R107.3, R107.4

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

SECTION R107 TEMPORARY USES, STRUCTURES, EQUIPMENT AND ~~STRUCTURES~~-SYSTEMS

R107.1 General. The *building official* is authorized to issue a permit for temporary uses, structures, equipment, or systems. Such *permits* shall be limited as to time of service, but shall not be permitted for more than 180 days. The *building official* is authorized to grant extensions for demonstrated cause.

R107.2 Conformance. Temporary uses, structures, equipment or systems shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the health, safety and general welfare.

R107.3 Temporary power. The building official is authorized to give permission to temporarily supply utilities, sources of energy, fuel, power, water systems or sewer systems before an installation has been fully completed and the final approval has been issued. The part covered by the temporary approval shall comply with the requirements specified for temporary lighting, heat or power in this code.

R107.4 Termination of approval. The building official is authorized to terminate such permit for temporary uses, structures, equipment, or system and to order the same to be discontinued.

Commenter's Reason: The IRC committee felt that temporary 'structures' should be included consistently in the sections of this proposal. This modification does that. There is also a public comment to ADM32-19 Part 1 to coordinate this with the other codes that deal with structures. BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-techsupport/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1223

ADM33-19 Part II

IECC@: SECTION C104, C104.1, C104.2, C104.3, C104.4, C104.5, C104.6

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

SECTION C104 FEES

C104.1 Fees- Payment of fees. A permit shall not be ~~issued valid~~ until the fees prescribed in ~~Section C104.2 by law~~ have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

C104.2 Schedule of permit fees. ~~A Where a permit is required, a~~ fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

C104.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor, for which the permit is being issued. If, in the opinion of the code official, the valuation is underestimated on the application, the permit shall be denied, unless the applicant can show detailed estimates to meet the approval of the code official. Final building permit valuation shall be set by the code official.

~~C104.3~~ **C104.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to ~~an additional a~~ fee established by the *code official* that shall be in addition to the required permit fees.

~~C104.4~~ **C104.5 Related fees.** The payment of the fee for the construction, *alteration*, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

~~C104.5~~ **C104.6 Refunds.** The *code official* is authorized to establish a refund policy.

Reason: There are two different proposals to address consistency in the Fees section – the end result would be coordination between all codes. The intent is consistency in language for 'Fees' within the codes – IBC, IFC, IEBC, IWUIC, IZC, Energy – Commercial and Residential.

- Payment of fees – consistent title, always two sentences
- Schedule of permit fees – IBC currently also includes “structures”, while IFC and IEBC also includes “alterations”. IWUIC and Energy do not include anything. Eliminate the laundry list and make all codes consistent.
- Permit valuation: added valuation to IWUIC and Energy; permits can be for other than just buildings
- Work commencing before permit issuance – remove redundant language
- Refunds – no change
- The IZC currently has a section on fees that is very limited. It was not clear what should be added other than a section on refunds.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

IBC

SECTION 109FEES

[A] 109.1 Payment of fees. A *permit* shall not be valid until the fees prescribed by law have been paid. Nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

[A] 109.2 Schedule of permit fees. Where a *permit* is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as

established by the applicable governing authority.

[A] 109.3 Permit valuations. The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the *building official*, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the *building official*. Final building *permit* valuation shall be set by the *building official*.

[A] 109.4 Work commencing before permit issuance. Any person who commences any work before obtaining the necessary *permits* shall be subject to a fee established by the *building official* that shall be in addition to the required *permit* fees.

[A] 109.5 Related fees. The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

[A] 109.6 Refunds. The *building official* is authorized to establish a refund policy.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable and Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac/>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM33-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Specificity is not needed in this section. These provisions are commonly modified by adopting jurisdictions to install their own fee structure. (Vote: 14-1)

Assembly Action:

None

ADM33-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Submitted

Commenter's Reason: We respectively disagrees with the Energy committee. The section on fees is existing. This proposal is only adding Section C104.3 for consistency within the family of codes.

Code change proposal ADM27 revised the Fee section where the fees where in the code to allow for the jurisdiction to set the codes and revise when they need to – rather than have it set when the code is adopted with no options for change.

Section 104.3 is current language in the 2018 editions of IRC, IEBC and IBC. ADM33 Part 1 and ADM27 together are to coordinate the fee section in the family of codes. This section does not require a fee for review or compliance with the energy code, but says where a permit is required.

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1224

ADM33-19 Part III

IECC@: SECTION R104, R104.1, R104.2, R104.3, R104.4, R104.5, R104.6

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

SECTION R104 FEES

R104.1 Fees- Payment of fees. A permit shall not be issued until the fees prescribed in ~~Section R104.2 by law~~ have been paid, ~~nor paid~~. Nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

R104.2 Schedule of permit fees. ~~A Where a permit is required, a~~ fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

R104.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor, for which the permit is being issued. If, in the opinion of the code official, the valuation is underestimated on the application, the permit shall be denied, unless the applicant can show detailed estimates to meet the approval of the code official. Final building permit valuation shall be set by the code official.

~~R104.3~~ **R104.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to ~~an additional a~~ fee established by the *code official* that shall be in addition to the required permit fees.

~~R104.4~~ **R104.5 Related fees.** The payment of the fee for the construction, *alteration*, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

~~R104.5~~ **R104.6 Refunds.** The *code official* is authorized to establish a refund policy.

Reason: There are two different proposals to address consistency in the Fees section – the end result would be coordination between all codes. The intent is consistency in language for 'Fees' within the codes – IBC, IFC, IEBC, IWUIC, IZC, Energy – Commercial and Residential.

- Payment of fees – consistent title, always two sentences
- Schedule of permit fees – IBC currently also includes “structures”, while IFC and IEBC also includes “alterations”. IWUIC and Energy do not include anything. Eliminate the laundry list and make all codes consistent.
- Permit valuation: added valuation to IWUIC and Energy; permits can be for other than just buildings
- Work commencing before permit issuance – remove redundant language
- Refunds – no change
- The IZC currently has a section on fees that is very limited. It was not clear what should be added other than a section on refunds.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

IBC

SECTION 109FEES

[A] 109.1 Payment of fees. A *permit* shall not be valid until the fees prescribed by law have been paid. Nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

[A] 109.2 Schedule of permit fees. Where a *permit* is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as

established by the applicable governing authority.

[A] 109.3 Permit valuations. The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the *building official*, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the *building official*. Final building *permit* valuation shall be set by the *building official*.

[A] 109.4 Work commencing before permit issuance. Any person who commences any work before obtaining the necessary *permits* shall be subject to a fee established by the *building official* that shall be in addition to the required *permit* fees.

[A] 109.5 Related fees. The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

[A] 109.6 Refunds. The *building official* is authorized to establish a refund policy.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable and Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

ADM33-19 Part III

Public Hearing Results

Committee Action:

Disapproved

Committee Modification: fE

Committee Reason: Fees should not be set by the code official. Fees should not be specified within the code. The proposal gives authority to the code official to set fees, but such can not be appealed as this code has no appeal process. The inclusion of labor cost of inspections in the determination of fees was questioned. (Vote: 10-1)

Assembly Action:

None

ADM33-19 Part III

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Submitted

Commenter's Reason: We respectively disagrees with the Energy committee. The section on fees is existing. This proposal is only adding Section C104.3 for consistency within the family of codes.

Code change proposal ADM27 revised the Fee section where the fees where in the code to allow for the jurisdiction to set the codes and revise when they need to – rather than have it set when the code is adopted with no options for change.

Section 104.3 is current language in the 2018 editions of IRC, IEBC and IBC. ADM33 Part 1 and ADM27 together are to coordinate the fee section in the family of codes. This section does not require a fee for review or compliance with the energy code, but says where a permit is required.

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1225

NOTE: ADM33-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM33-19 Part I

IBC®: SECTION 109, [A] 109.1, [A] 109.2, [A] 109.3, [A] 109.4, [A] 109.5, [A] 109.6; IFC®: SECTION 106, [A] 106.1, [A] 106.2, 106.3 (New), [A] 106.4, [A] 106.5, [A] 106.6; IEBC®: SECTION 108, [A] 108.1, [A] 108.2, [A] 108.3, [A] 108.4, [A] 108.5, [A] 108.6; IWUIC®: SECTION 109, [A] 109.1, [A] 109.2, 109.3, [A] 109.4, [A] 109.5, [A] 109.6; IZC®: SECTION 111, [A] 111.1, 111.2

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

THIS IS A 4 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. PART III WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. PART IV WILL BE HEARD BY THE IgCC CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows:

SECTION 109 FEES

[A] 109.1 Payment of fees. A *permit* shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

[A] 109.2 Schedule of permit fees. ~~On buildings, structures, electrical, gas, mechanical, and plumbing systems or alterations requiring~~ Where a permit is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

[A] 109.3 ~~Building permit~~ Permit valuations. The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the *building official*, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the *building official*. Final building *permit* valuation shall be set by the *building official*.

[A] 109.4 Work commencing before permit issuance. Any person who commences any ~~work on a building, structure, electrical, gas, mechanical or plumbing system before work before~~ obtaining the necessary *permits* shall be subject to a fee established by the *building official* that shall be in addition to the required *permit* fees.

[A] 109.5 Related fees. The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a building *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

[A] 109.6 Refunds. The *building official* is authorized to establish a refund policy.

2018 International Fire Code

Revise as follows:

SECTION 106 FEES

[A] 106.1 Fees. A permit shall not be issued until the fees have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

[A] 106.2 Schedule of permit fees. ~~A-Where a permit is required,~~ a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

Add new text as follows:

106.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor, for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment and

permanent systems. If, in the opinion of the fire code official, the valuation is underestimated on the application, the permit shall be denied, unless the applicant can show detailed estimates to meet the approval of the fire code official. Final permit valuation shall be set by the fire code official.

Revise as follows:

[A] ~~106.3~~ **106.4 Work commencing before permit issuance.** A person who commences any work, activity or operation regulated by this code before obtaining the necessary permits shall be subject to ~~an additional a~~ fee established by the applicable governing authority, which shall be in addition to the required permit fees.

[A] ~~106.4~~ **106.5 Related fees.** The payment of the fee for the construction, *alteration*, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

[A] ~~106.5~~ **106.6 Refunds.** The applicable governing authority is authorized to establish a refund policy.

2018 International Existing Building Code

Revise as follows:

SECTION 108 FEES

[A] **108.1 Payment of fees.** A permit shall not be valid until the fees prescribed by law have been paid. ~~Nor paid nor~~ shall an amendment to a permit be released until the additional fee, if any, has been paid.

[A] **108.2 Schedule of permit fees.** ~~On buildings, electrical, gas, mechanical, and plumbing systems or alterations requiring~~ Where a permit is required, a fee for each permit shall be paid as required_ in accordance with the schedule as established by the applicable governing authority.

[A] ~~108.3 Building permit~~ **Permit valuations.** The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work including materials and labor for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment, and permanent systems. If, in the opinion of the *code official*, the valuation is underestimated on the application, the permit shall be denied unless the applicant can show detailed estimates to meet the approval of the *code official*. Final building permit valuation shall be set by the *code official*.

[A] **108.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to ~~an additional a~~ fee established by the *code official* that shall be in addition to the required permit fees.

[A] **108.5 Related fees.** The payment of the fee for the construction, *alteration*, removal, or demolition of work done in connection to or concurrently with the work authorized by ~~a building a~~ permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

[A] **108.6 Refunds.** The *code official* is authorized to establish a refund policy.

2018 International Wildland-Urban Interface Code

Revise as follows:

SECTION 109 FEES

[A] ~~109.1 Fees-~~ **Payment of fees.** A permit shall not be issued until the fees prescribed in ~~Section 109.2 by law~~ have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid

[A] **109.2 Schedule of permit fees.** ~~A~~ Where a permit is required, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

109.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor, for which the permit is being issued. If, in the opinion of the applicable governing authority, the valuation is underestimated on the application, the permit shall be denied, unless the applicant can show detailed estimates to meet the approval of the applicable governing authority. Final building permit valuation shall be set by the applicable governing authority.

[A] ~~109.3~~ **109.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to ~~an additional a~~ fee established by the applicable governing authority, which shall be in addition to the required permit fees.

[A] ~~109.4~~ **109.5 Related fees.** The payment of the fee for the construction, alteration, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

[A] ~~109.5~~ 109.6 **Refunds.** The applicable governing authority is authorized to establish a refund policy.

2018 International Zoning Code

Revise as follows:

SECTION 111 FEES

[A] **111.1 Fees.** A fee for services shall be charged. Fees shall be set by the jurisdiction and schedules shall be available at the office of the code official.

111.2 Refunds. The code official is authorized to establish a refund policy.

Reason: There are two different proposals to address consistency in the Fees section – the end result would be coordination between all codes. The intent is consistency in language for ‘Fees’ within the codes – IBC, IFC, IEBC, IWUIC, IZC, Energy – Commercial and Residential.

- Payment of fees – consistent title, always two sentences
- Schedule of permit fees – IBC currently also includes “structures”, while IFC and IEBC also includes “alterations”. IWUIC and Energy do not include anything. Eliminate the laundry list and make all codes consistent.
- Permit valuation: added valuation to IWUIC and Energy; permits can be for other than just buildings
- Work commencing before permit issuance – remove redundant language
- Refunds – no change
- The IZC currently has a section on fees that is very limited. It was not clear what should be added other than a section on refunds.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

IBC

SECTION 109FEES

[A] **109.1 Payment of fees.** A *permit* shall not be valid until the fees prescribed by law have been paid. Nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

[A] **109.2 Schedule of permit fees.** Where a *permit* is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

[A] **109.3 Permit valuations.** The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the *building official*, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the *building official*. Final building *permit* valuation shall be set by the *building official*.

[A] **109.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary *permits* shall be subject to a fee established by the *building official* that shall be in addition to the required *permit* fees.

[A] **109.5 Related fees.** The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

[A] **109.6 Refunds.** The *building official* is authorized to establish a refund policy.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable and Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the

proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM33-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change. Corrected hearing committee banner.

Committee Action:

As Modified

Committee Modification:
2018 International Fire Code

106.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor, for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the building fire code official, the valuation is underestimated on the application, the permit shall be denied, unless the applicant can show detailed estimates to meet the approval of the building fire code official. Final building permit valuation shall be set by the building fire code official.

Committee Reason: The committee stated that the reason for the approval of the modification was the specific improvement to the language for its use in the IFC by using the common title to match the existing language. The reason for approval of the proposal was based on the proponent's reason statement. (Vote: 13-0).

Assembly Action:

None

ADM33-19 Part I

NOTE: ADM33-19 PART IV RECEIVED A PUBLIC COMMENT THAT WAS FOUND TO BE EDITORIAL BY THE CODE CORRELATION COMMITTEE (CCC). PLEASE SEE CCC01-19 FOR THIS PUBLIC COMMENT.

ADM37-19 Part I

IBC®: [A] 110.6; IPC®: [A] 107.2.3; IMC®: [A] 107.2.3; IFGC®: [A] 107.2.3; IEBC®: [A] 109.6; ISPSC®: [A] 106.6; IPSDC®: [A] 107.4; IWUIC®: [A] 110.1.2.3; IFC®: [A] 107.2.2

Proposed Change as Submitted

Proponents: Robert DeVries, representing Self (rdevries@nuwool.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEES.

2018 International Building Code

Revise as follows:

[A] 110.6 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *building official*. The *building official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the *permit* holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *building official*.

2018 International Plumbing Code

Revise as follows:

[A] 107.2.3 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Mechanical Code

Revise as follows:

[A] 107.2.3 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Fuel Gas Code

[A] 107.2.3 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Existing Building Code

:

[A] 109.6 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, on notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.

2018 International Swimming Pool and Spa Code

:

[A] 106.6 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspection and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this ~~code.~~ The notification

shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Private Sewage Disposal Code

:

[A] 107.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Wildland-Urban Interface Code

Revise as follows:

[A] 110.1.2.3 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Fire Code

Revise as follows:

[A] 107.2.2 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *fire code official*. The *fire code official*, on notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing and include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected, and such portion shall not be covered or concealed until authorized by the *fire code official*.

Reason: As written there is no set method of notification. Putting the violation in writing including the chapter and section number(s) would greatly improve the permit holders understanding of the violation. This would reduce the amount of communication and time required to determine the actual violation. Having the chapter and section number(s) would give the permit holder immediate direction as to how to correct the violation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. While no cost impact was selected an argument could be made that the permit holder may save money by saving time trying to contact the building official.

ADM37-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee stated that the reasons for disapproval were as follows: making this a mandatory requirement is too much of a burden to have to provide the information for every violation, the information can already be requested and that it should be up to each jurisdiction to determine the need for providing the information. Those that were opposed to the disapproval stated that the applicant is entitled to the information, it acts as an educator and it should be specific in order to avoid unnecessary repeated inspections. (Vote: 9-4)

Assembly Action:

None

ADM37-19 Part I

Individual Consideration Agenda

Public Comment 1:

IBC®: [A] 110.6; IPC®: [A] 107.2.3; IMC®: [A] 107.2.3; IFGC®: [A] 107.2.3; IEBC®: [A] 109.6; ISPSC®: [A] 106.6; IPSDC®: [A] 107.4;

IWUIC®: [A] 110.1.2.3; IFC®: [A] 107.2.2

Proponents:

Stephen Thomas, representing Colorado Chapter (sthomas@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

[A] 110.6 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *building official*. The *building official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the *permit* holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the building official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *building official*.

2018 International Plumbing Code

[A] 107.2.3 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Mechanical Code

[A] 107.2.3 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Fuel Gas Code

[A] 107.2.3 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Existing Building Code

[A] 109.6 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, on notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.

2018 International Swimming Pool and Spa Code

[A] 106.6 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspection and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Private Sewage Disposal Code

[A] 107.4 **Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Wildland-Urban Interface Code

[A] 110.1.2.3 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

2018 International Fire Code

[A] 107.2.2 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *fire code official*. The *fire code official*, on notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. The notification shall be in writing, ~~and~~ When requested, the fire code official shall include specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected, and such portion shall not be covered or concealed until authorized by the *fire code official*.

Commenter's Reason: The original proposal was too restrictive for many jurisdictions. There is not enough time to include the section numbers for every item found during an inspection. In addition, most inspectors do not memorize specific code references. Therefore, they would need to take the time to look up the reference in the code. Therefore, the committee disapproved this item. We agree with the proponent that some inspectors require things that are not reference in the code. They prefer to have buildings built the way they would build them. Therefore, it is reasonable that if the builder requests a code reference, the inspector should be able to provide that information. If it is not in the code, they should not be requiring it. We have proposed language that would require the inspector to provide the code reference when requested by the builder, owner or architect. This is reasonable request.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an administrative requirement on the inspector and should not affect the cost of construction at all.

Public Comment# 1325

ADM37-19 Part II

IRC@: R109.4

Proposed Change as Submitted

Proponents: Robert DeVries, representing Self (rdevries@nuwool.com)

2018 International Residential Code

Revise as follows:

R109.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *building official*. The *building official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the *permit* holder or an agent of the *permit* holder wherein the same fails to comply with this code. The notification shall include, in writing, specific reference to the code chapter and section number(s) in violation. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *building official*.

Reason: As written there is no set method of notification. Putting the violation in writing including the chapter and section number(s) would greatly improve the permit holders understanding of the violation. This would reduce the amount of communication and time required to determine the actual violation. Having the chapter and section number(s) would give the permit holder immediate direction as to how to correct the violation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

While no cost impact was selected an argument could be made that the permit holder may save money by saving time trying to contact the building official.

ADM37-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is language that addresses a local process. It is not suited for a national code. These requirements would slow down the inspection process. (Vote: 9-2)

Assembly Action:

None

ADM37-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC@: R109.4

Proponents:

Stephen Thomas, representing Colorado Chapter (stthomas@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R109.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *building official*. The *building official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the *permit* holder or an agent of the *permit* holder wherein the same fails to comply with this code. The notification shall ~~include, be in writing,~~ Where requested, the building official shall provide specific reference to the code chapter and section number(s) that is (are) being violated. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *building official*.

Commenter's Reason: The original proposal was too restrictive for many jurisdictions. There is not enough time to include the section numbers for every item found during an inspection. In addition, most inspectors do not memorize specific code references. Therefore, they would need to take the time to look up the reference in the code. Therefore, the committee disapproved this item. We agree with the proponent that some inspectors require things that are not reference in the code. They prefer to have buildings built the way they would build them. Therefore, it is reasonable that if the builder requests a code reference, the inspector should be able to provide that information. If it is not in the code, they should not be requiring it. We have proposed language that would require the inspector to provide the code reference when requested by the builder, owner or architect. This is reasonable request.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an administrative change for the inspector and will not affect the cost of construction.

Public Comment# 1327

ADM39-19 Part II

IRC@: SECTION R111, R111.1, R111.2, R111.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R111 SERVICE UTILITIES

R111.1 Connection of service utilities. A person shall not make connections from a utility, source of energy, fuel, or power, water system or sewer system to any building or system that is regulated by this code for which a permit is required, until approved by the building official.

R111.2 Temporary connection. The building official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel or power, water system or power system for the purpose of testing systems or for use under a temporary approval.

R111.3 Authority to disconnect service utilities. The *building official* shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards ~~set forth in Section R102.4 in~~ in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section R111.1 or R111.2. The *building official* shall notify the serving utility and where possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnection, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing as soon as practical thereafter.

ADM39-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This would be in violation of the requirements of many public utilities across the country. (Vote: 6-4)

Assembly Action:

None

ADM39-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC@: R111.2

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R111.2 Temporary connection. The building official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel power, water system or ~~power~~ sewer system for the purpose of testing systems or for use under a temporary approval.

Commenter's Reason: There was no testimony for or against this proposal. The committee was split in their decision. The ICC is a family of codes – Part 1 was approved with the editorial modification indicated here. Connection (through the local utility) would be permitted for testing of a system (per Section R111.2).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-techsupport/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1226

NOTE: ADM39-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM39-19 Part I

IBC®: SECTION 112, [A] 112.1, [A] 112.2, [A] 112.3; IPC®: SECTION 108, 108.1, 108.2, 108.3; IMC®: SECTION 108, [A] 108.1, [A] 108.2, 108.3; IFGC®: SECTION 108, [A] 108.1, [A] 108.2, 108.3; IEBC®: SECTION 111, [A] 111.1, [A] 111.2, [A] 111.3; IPSDC®: SECTION 108, [A] 108.1, [A] 108.2, 108.3; IWUIC®: SECTION 113, [A] 113.1, 113.2, [A] 113.3; ISPSC®: SECTION 107, [A] 107.1, [A] 107.2, 107.3

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEES.

2018 International Building Code

Revise as follows:

SECTION 112 SERVICE UTILITIES

[A] 112.1 Connection of service utilities. A person shall not make connections from a utility, source of energy, fuel, ~~or power~~, water system or sewer system to any building or system that is regulated by this code for which a permit is required, until ~~released~~ approved by the building official.

[A] 112.2 Temporary connection. The building official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, ~~or power~~, water system or power system for the purpose of testing systems or for use under a temporary approval.

[A] 112.3 Authority to disconnect service utilities. The building official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards ~~set forth in Section 101.4~~ in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 112.1 or 112.2. The building official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

2018 International Plumbing Code

Revise as follows:

SECTION 108 SERVICE UTILITIES

~~107.7~~ **108.1 Connection of service utilities.** A person shall not make connections from a utility, source of energy, fuel, power, water system or sewer system to any building or system that is regulated by this code for which a permit is required until authorized by the code official.

~~107.6~~ **108.2 Temporary connection.** The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or power system for the purpose of testing plumbing systems or for use under a temporary ~~certificate of occupancy~~ approval.

108.3 Authority to disconnect service utilities. The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 108.1 or 108.2. The code official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

2018 International Mechanical Code

Revise as follows:

SECTION 108 SERVICE UTILITIES

[A] ~~407-6~~ **108.1 Connection of service utilities.** A person shall not make connections from a utility, source of energy, fuel or power to any building or system that is regulated by this code for which a permit is required, until authorized by the code official.

[A] ~~407-5~~ **108.2 Temporary connection.** The code official shall have the authority to authorize the temporary connection of ~~a mechanical~~ the building or system to the ~~sources~~ utility, source of energy, fuel, power, water system or power system for the purpose of testing ~~mechanical~~ systems or for use under a temporary ~~certificate of occupancy~~ approval.

108.3 Authority to disconnect service utilities. The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 108.1 or 108.2. The code official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

2018 International Fuel Gas Code

Revise as follows:

SECTION 108 SERVICE UTILITIES

[A] ~~407-6~~ **108.1 Connection of service utilities.** A person shall not make connections from a utility, source of energy, fuel or power to any building or system that is regulated by this code for which a permit is required until authorized by the code official.

[A] ~~407-5~~ **108.2 Temporary connection.** The code official shall have the authority to ~~allow~~ authorize the temporary connection of ~~an installation~~ the building or system to the ~~sources~~ utility, source of energy, fuel, power, water system or power system for the purpose of testing ~~the installation~~ systems or for use under a temporary ~~certificate of occupancy~~ approval.

108.3 Authority to disconnect service utilities. The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 108.1 or 108.2. The code official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

2018 International Existing Building Code

Revise as follows:

SECTION 111 SERVICE UTILITIES

[A] **111.1 Connection of service utilities.** A person shall not make connections from a utility, source of energy, fuel, ~~or~~ power, water system or sewer system to any building or system that is regulated by this code for which a permit is required, until *approved* by the *code official*.

[A] **111.2 Temporary connection.** The *code official* shall shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, ~~or~~ power, water system or power system for the purpose of testing systems or for use under a temporary approval.

[A] **111.3 Authority to disconnect service utilities.** The *code official* shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 111.1 or 111.2. The *code official* shall notify the serving utility and, wherever possible, the owner or the owner's authorized agent and the occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

2018 International Private Sewage Disposal Code

Revise as follows:

SECTION 108 SERVICE UTILITIES

[A] ~~107.9~~ **108.1 Connection of service utilities.** No person shall make connections from a utility, source of energy, fuel or power to any building or system that is regulated by this code for which a permit is required until authorized by the code official.

[A] ~~107.8~~ **108.2 Temporary connection.** The code official shall have the authority to ~~allow~~ authorize the temporary connection of ~~an installation the building or system to the sources utility, source of energy, fuel, power, water system or power system~~ for the purpose of testing ~~the installation systems~~ or for use under a temporary ~~certificate of occupancy approval~~.

108.3 Authority to disconnect service utilities. The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 108.1 or 108.2. The code official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

2018 International Wildland-Urban Interface Code

Revise as follows:

SECTION 113 SERVICE UTILITIES

[A] **113.1 Connection of service utilities.** Any person shall not make connections from a utility, source of energy, fuel, or power, ~~to water system or sewer system~~ to any building or system that is regulated by this code for which a permit is required until ~~released~~ approved by the code official.

113.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or power system for the purpose of testing systems or for use under a temporary approval.

[A] ~~113.2~~ **113.3 Authority to disconnect service utilities.** The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and ~~standards set forth in Section 102.4 in standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the release approval required by Section 113.1 and 113.2.~~ The code official shall notify the serving utility and, where possible, the owner or the owner's authorized agent and the occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnection, the owner, the owner's authorized agent or the occupant of the building, structure or service system shall be notified in writing as soon as practical thereafter.

2018 International Swimming Pool and Spa Code

Revise as follows:

SECTION 107 SERVICE UTILITIES

[A] ~~106.19~~ **107.1 Connection of service utilities.** A person shall not make connections from a utility, source of energy, fuel, power, water system or sewer system to any building or system that is regulated by this code for which a permit is required until authorized by the code official.

[A] ~~106.18~~ **107.2 Temporary connection.** The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or power system for the purpose of testing systems or for use under a temporary approval.

107.3 Authority to disconnect service utilities. The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 107.1 or 107.2. The code official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

Reason: The main purpose of this proposal is coordination between codes for the section on connection to services – including those coming from utilities or generated on-site. Revisions for the section on temporary services is addressed in a separate proposal. Some of the codes had service utility requirements as part of the inspection section. For consistency across codes, it is proposed to move this to a separate section. Codes have references to codes and standards throughout the document, so a reference back to the list at the beginning of Chapter 1 is not inclusive (IBC, IRC, IWUIC). The list should include all the systems – not all codes included water and sewer systems – so it is proposed to be added as it is currently in the IPC. The authority to disconnect is an important safety feature that needs to be included in all the codes that deal with service utilities. It is proposed to be added to the codes that do not include that provision.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a

series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

IBC

SECTION 112

SERVICE UTILITIES

[A] 112.1 Connection of service utilities. A person shall not make connections from a utility, source of energy, fuel, power, water system or sewer system to any building or system that is regulated by this code for which a *permit* is required, until approved by the *building official*.

[A] 112.2 Temporary connection. The *building official* shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or power system for the purpose of testing systems or for use under a temporary approval.

[A] 112.3 Authority to disconnect service utilities. The *building official* shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 112.1 or 112.2. The *building official* shall notify the serving utility, and wherever possible the *owner* or the owner’s authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the *owner*, the owner’s authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM39-19 Part I

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
2018 International Building Code

[A] 112.2 Temporary connection. The building official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

2018 International Plumbing Code

108.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing plumbing systems or for use under a temporary approval.

2018 International Mechanical Code

[A] 108.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

2018 International Fuel Gas Code

[A] 108.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

2018 International Existing Building Code

[A] 111.2 Temporary connection. The *code official* shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

2018 International Private Sewage Disposal Code

[A] 108.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

2018 International Wildland-Urban Interface Code

113.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

2018 International Swimming Pool and Spa Code

[A] 107.2 Temporary connection. The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or ~~power sewer~~ system for the purpose of testing systems or for use under a temporary approval.

Committee Reason: The reason for the approval of the modification was to improve the language to include sewer systems within the scope of the temporary connection section. The reason for the approval of the proposal was based on the proponent's reason statement. (Vote: 13-0)

Assembly Action:

None

ADM39-19 Part I

ADM40-19 Part II

IRC@: SECTION R112, R112.1, R112.2, R112.3, R112.4

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R112 BOARD MEANS OF APPEALS

R112.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The ~~building official shall be an ex officio member of said board but shall not have a vote on any matter before the board.~~ The board of appeals shall be appointed by the applicable governing body authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business ; and shall render all decisions and findings in writing to the appellant with a duplicate copy to the building official.

R112.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good equivalent~~ or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

R112.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training to pass judgement on matters pertaining to building construction and are not employees of the *jurisdiction*.

R112.4 Administration. The *building official* shall take immediate action in accordance with the decision of the board.

Reason: The intent is to establish consistent language for the means of appeal throughout the code. The constitution of the board of appeals will be addressed in another change. There is some slight difference in the fire code in the section on limitations on authority and qualification where some differences given the scope of the code are appropriate to remain. The IPMC includes an additional section for stays of enforcement. The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

SECTION 113

MEANS OF APPEALS

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

[A] 113.4 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable,

Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial proposal with no change to construction requirements.

ADM40-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

Disapproved

Committee Reason: The code official needs to be able to give the board guidance and help interpret what is required by the code. We need to be able to appeal the entire code and not leave certain parts out. (Vote: 11-0)

Assembly Action:

None

ADM40-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Submitted

Commenter's Reason: ADM40 Part 1, 4 and 5 were approved for IBC, IEBC, IFC, IWUIC, IPC, IMC, IFGC, ISPSC, IPMC, IPSDC, IECC-Residential, IGCC. The committee had concerns about the make up of the board, and where a local or state jurisdiction made decisions. This section is to address the means for someone to appeal. The requirements for the board is addressed in ADM43. Section R112.1 had the following sentence deleted (The *building official* shall be an ex officio member of said board but shall not have a vote on any

matter before the board.) This is already addressed in R112.3 with the board not being able to be employees of the jurisdiction. The code official would typically be involved in the process to provide information.

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-techsupport/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1227

ADM40-19 Part III

IECC@: SECTION C109, C109.1, C109.2, C109.3, C109.4

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

SECTION C109 ~~BOARD MEANS OF APPEALS~~

C109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. ~~The code official shall be an ex officio member of said board but shall not have a vote on any matter before the board.~~ The board of appeals shall be appointed by the applicable governing body authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business ; and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

C109.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good equivalent~~ or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

C109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

C109.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

Reason: The intent is to establish consistent language for the means of appeal throughout the code. The constitution of the board of appeals will be addressed in another change. There is some slight difference in the fire code in the section on limitations on authority and qualification where some differences given the scope of the code are appropriate to remain. The IPMC includes an additional section for stays of enforcement. The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

SECTION 113

MEANS OF APPEALS

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

[A] 113.4 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable,

Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial proposal with no change to construction requirements.

ADM40-19 Part III

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposed revisions place an undue burden on code officials. It is unreasonable to expect 'immediate' action. Perhaps 'timely' may be a better term. (Vote 12-3)

Assembly Action:

None

ADM40-19 Part III

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Submitted

Commenter's Reason: ADM40 Parts 1, 4 and 5 were approved for coordination between IBC, IEBC, IFC, IWUIC, IPC, IMC, IFGC, ISPSC, IPMC, IPSDC, IECC-Residential, IGCC. The committee was concerned about the word "immediate" in Section 113.4. This is in the current IRC. It is only applicable if a building has gone through a means of appeals and the board has made a decision. This should not be an undue burden on a building official. The intent is only to address the concern in a timely manner – not immediately following the meeting.

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the

International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial change that provides consistency between I-codes.

Public Comment# 1228

NOTE: ADM40-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM40-19 Part I

IBC®: SECTION 113, [A] 113.1, [A] 113.2, [A] 113.3, 113.4 (New); IEBC®: SECTION 112, [A] 112.1, [A] 112.2, [A] 112.3, 113.4 (New); IFC®: SECTION 109, [A] 109.1, [A] 109.2, [A] 109.3, 109.4 (New); IWUIC®: SECTION 106, [A] 106.1, [A] 106.2, 106.3 (New), 106.4; IPC®: SECTION 109, 109.1 (New), 109.2, 109.3, 109.4, SECTION 110, 110.1; IMC®: SECTION 109, 109.1 (New), [A] 109.2, [A] 109.1.1, 109.3 (New), 109.4, SECTION 110, [A] 110.1; IFGC®: SECTION 109 (IFGC), 109.1, [A] 109.2, 109.3, 109.4, SECTION 110, [A] 110.1; ISPSC®: SECTION 108, 108.1, [A] 108.2, 108.3, 108.4, SECTION 109, [A] 109.1; IPMC®: SECTION 111, 111.1, [A] 111.2, 111.3, 111.4, [A] 111.5, SECTION 112, [A] 112.1; IPSDC®: SECTION 109, 109.1, [A] 109.2, 109.3, 109.4, SECTION 110, [A] 110.1

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

THIS IS A 5 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. PART III WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. PART IV WILL BE HEARD BY THE IECC-RESIDENTIAL CODE COMMITTEE. PART V WILL BE HEARD BY THE IgCC CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows:

SECTION 113 ~~BOARD MEANS OF APPEALS~~

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the building official.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good equivalent~~ or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

Add new text as follows:

113.4 Administration. The building official shall take immediate action in accordance with the decision of the board.

2018 International Existing Building Code

Revise as follows:

SECTION 112 ~~BOARD MEANS OF APPEALS~~

[A] 112.1 General. In order to hear and decide appeals of orders, decisions ~~;~~ or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing ~~body~~ authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the building official.

[A] 112.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply ~~;~~ or an ~~equally good equivalent~~ or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 112.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

Add new text as follows:

113.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

2018 International Fire Code

Revise as follows:

SECTION 109 BOARD MEANS OF APPEALS

[A] **109.1 Board of appeals established.** In order to hear and decide appeals of orders, decisions or determinations made by the fire code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing body authority and shall hold office at its pleasure. ~~The fire code official shall be an ex officio member of said board but shall not have a vote on any matter before the board.~~ The board shall adopt rules of procedure for conducting its business ; and shall render all decisions and findings in writing to the appellant with a duplicate copy to the fire code official.

[A] **109.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted hereunder thereunder have been incorrectly interpreted, the provisions of this code do not fully apply ; or an equivalent ~~method of protection or safety or better form of construction~~ is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] **109.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to hazards of fire, explosions, hazardous conditions or *fire protection systems*, and are not employees of the jurisdiction.

Add new text as follows:

109.4 Administration. The fire code official shall take immediate action in accordance with the decision of the board.

2018 International Wildland-Urban Interface Code

Revise as follows:

SECTION 106 MEANS OF APPEALS

[A] **106.1 General.** ~~To determine the suitability of alternative materials and methods and to provide for reasonable interpretations of the provisions in order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby is created a board of appeals consisting of five members who are qualified by experience and training to pass judgment on pertinent matters. The code official, building official and fire chief shall be ex officio members, and the code official shall act as secretary of the board. The appeals. The board of appeals shall be appointed by the legislative body applicable governing authority and shall hold office at their discretion its pleasure. The board shall adopt reasonable rules and regulations of procedure for conducting its investigations business and shall render all decisions and findings in writing to the code official, appellant with a duplicate copy to the applicant code official.~~

[A] **106.2 Limitations of authority.** ~~The board of appeals shall not have authority relative to interpretation of the administrative provisions of this code and~~ An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

Add new text as follows:

106.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

Revise as follows:

106.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

2018 International Plumbing Code

Revise as follows:

SECTION 109 MEANS OF APPEAL APPEALS

Add new text as follows:

109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and

interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

Revise as follows:

~~109.1 109.2 Application for appeal: Limitations on authority.~~ Any person shall have the right to appeal a decision of the code official to the board of appeals. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply, or an equally good equivalent or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served. board shall not have authority to waive requirements of this code or interpret the administration of this code.

109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

109.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

SECTION 110 **BOARD OF APPEALS**

~~109.2 110.1 Membership of board.~~ The board of appeals shall consist of five members appointed by the chief appointing authority as follows: one for 5 years, one for 4 years, one for 3 years, one for 2 years and one for 1 year. Thereafter, each new member shall serve for 5 years or until a successor has been appointed.

2018 International Mechanical Code

Revise as follows:

SECTION 109 **MEANS OF APPEAL APPEALS**

Add new text as follows:

109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

Revise as follows:

~~[A] 109.1 109.2 Application for appeal: Limitations on authority.~~ A person shall have the right to appeal a decision of the code official to the board of appeals. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply, or an equally good equivalent or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served. board shall not have authority to waive requirements of this code or interpret the administration of this code.

Delete without substitution:

~~[A] 109.1.1 Limitation of authority.~~ The board of appeals shall not have authority relative to interpretation of the administration of this code nor shall such board be empowered to waive requirements of this code.

Add new text as follows:

109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

Revise as follows:

109.4 Administration The code official shall take immediate action in accordance with the decision of the board.

SECTION 110 **BOARD OF APPEALS**

~~[A] 109.2 110.1 Membership of board.~~ The board of appeals shall consist of five members appointed by the chief appointing authority as follows: one for 5 years; one for 4 years; one for 3 years; one for 2 years; and one for 1 year. Thereafter, each new member shall serve for 5 years or until a successor has been appointed.

2018 International Fuel Gas Code

Revise as follows:

SECTION 109 (IFGC) MEANS OF APPEAL

109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

~~[A] 109.1 109.2 Application for appeal. Limitations on authority.~~ A person shall have the right to appeal a decision of the code official to the board of appeals. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good equivalent or better form of construction is proposed. ~~The application shall be filed on a form obtained from the code official within 20 days after the notice was served. board shall not have authority to waive requirements of this code or interpret the administration of this code.~~

109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

109.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

SECTION 110 BOARD OF APPEALS

~~[A] 109.2 110.1 Membership of board.~~ The board of appeals shall consist of five members appointed by the chief appointing authority as follows: one for 5 years; one for 4 years; one for 3 years; one for 2 years and one for 1 year. Thereafter, each new member shall serve for 5 years or until a successor has been appointed.

2018 International Swimming Pool and Spa Code

Revise as follows:

SECTION 108 MEANS OF APPEAL

108.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

~~[A] 108.1 108.2 Application for appeal. Limitations on authority.~~ Any person shall have the right to appeal a decision of the code official to the board of appeals. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted ~~there under~~ thereunder have been incorrectly interpreted, the provisions of this code do not fully apply, or an equally good equivalent or better form of construction is proposed. ~~The application shall be filed on a form obtained from the code official within 20 days after the notice was served. board shall not have authority to waive requirements of this code or interpret the administration of this code.~~

108.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

108.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

SECTION 109 BOARD OF APPEALS

~~[A] 108.2 109.1 Membership of board.~~ The board of appeals shall consist of five members appointed by the chief appointing authority as follows: one for 5 years, one for 4 years, one for 3 years, one for 2 years and one for 1 year. Thereafter, each new member shall serve for 5 years or until a successor has been appointed.

2018 International Property Maintenance Code

Revise as follows:

SECTION 111 MEANS OF APPEAL

111.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and

interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

~~[A] **111.1 111.2 Application for appeal. Limitations on authority.** Any person directly affected by a decision of the *code official* or a notice or order issued under this code shall have the right to appeal to the board of appeals, provided that a written application for appeal is filed within 20 days after the day the decision, notice or order was served. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply, ~~or the~~ or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code ~~are adequately satisfied by other means, or interpret the administration of this code.~~~~

111.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

111.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

~~[A] **111.8 111.5 Stays of enforcement.** Appeals of notice and orders (other than *Imminent Danger* notices) shall stay the enforcement of the notice and order until the appeal is heard by the appeals board.~~

SECTION 112 **BOARD OF APPEALS**

~~[A] **111.2 112.1 Membership of board.** The board of appeals shall consist of not less than three members who are qualified by experience and training to pass on matters pertaining to property maintenance and who are not employees of the jurisdiction. The *code official* shall be an ex-officio member but shall not vote on any matter before the board. The board shall be appointed by the chief appointing authority, and shall serve staggered and overlapping terms.~~

2018 International Private Sewage Disposal Code

Revise as follows:

SECTION 109 **MEANS OF APPEAL**

109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

~~[A] **109.1 109.2 Application for appeal. Limitations on authority.** Any person shall have the right to appeal a decision of the code official to the board of appeals. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder ~~has have~~ been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good~~ equivalent or better form of construction is proposed. The ~~application shall be filed on a form obtained from the code official within 20 days after the notice was served.~~ board shall not have authority to waive requirements of this code or interpret the administration of this code.~~

109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

109.4 Administration The code official shall take immediate action in accordance with the decision of the board.

SECTION 110 **BOARDS OF APPEALS**

~~[A] **109.2 110.1 Membership of board.** The board of appeals shall consist of five members appointed by the chief appointing authority as follows: one for 5 years, one for 4 years, one for 3 years, one for 2 years and one for 1 year. Thereafter, each new member shall serve for 5 years or until a successor has been appointed.~~

Reason: The intent is to establish consistent language for the means of appeal throughout the code. The constitution of the board of appeals will be addressed in another change. There is some slight difference in the fire code in the section on limitations on authority and qualification where some differences given the scope of the code are appropriate to remain. The IPMC includes an additional section for stays of enforcement.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code

change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

SECTION 113

MEANS OF APPEALS

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

[A] 113.4 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial proposal with no change to construction requirements.

ADM40-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

As Submitted

Committee Reason: The committee stated that the reason for approval was based on the improvement of the language to correlate all the I-Codes. (Vote: 12-0)

Assembly Action:

None

ADM40-19 Part I

NOTE: ADM40-19 PART IV DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM40-19 Part IV

IECC@: SECTION R109, R109.1, R109.2, R109.3, R109.4

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Revise as follows:

SECTION R109 ~~BOARD MEANS OF APPEALS~~

R109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. ~~The code official shall be an ex officio member of said board but shall not have a vote on any matter before the board.~~ The board of appeals shall be appointed by the applicable governing body authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business ; and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

R109.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good equivalent~~ or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

R109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

Revise as follows:

R109.4 Administration. The code official shall take immediate action in accordance with the decision of the board.

Reason: The intent is to establish consistent language for the means of appeal throughout the code. The constitution of the board of appeals will be addressed in another change. There is some slight difference in the fire code in the section on limitations on authority and qualification where some differences given the scope of the code are appropriate to remain. The IPMC includes an additional section for stays of enforcement. The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

SECTION 113

MEANS OF APPEALS

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

[A] 113.4 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial proposal with no change to construction requirements.

ADM40-19 Part IV

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Consistent with the action taken on ADM40-19. Per the proponent's reason statement. (Vote: 10-1)

Assembly Action:

None

ADM40-19 Part IV

NOTE: ADM40-19 PART V DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM40-19 Part V

IGCC@: SECTION 108, 108.1, 108.2, 108.3, 108.4 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Green Construction Code

Revise as follows:

SECTION 108 **~~BOARD MEANS OF APPEALS~~**

108.1 General. ~~Appeals~~In order to hear and decide appeals of orders, decisions or determinations made by the authority having jurisdiction relative to the application and interpretation of this code, ~~there shall be made to a Board of Appeals as determined by the and is hereby created a board of appeals.~~ The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the authority having jurisdiction.

108.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted there under have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

108.3 Qualifications. ~~The members of the board of appeals related to interpretation of this code shall be~~ shall consist of members who are qualified by experience and training in the matters covered by this code and shall not be to pass on matters pertaining to building construction and are not employees of the jurisdiction.

Add new text as follows:

108.4 Administration The authority having jurisdiction shall take immediate action in accordance with the decision of the board.

Reason: The intent is to establish consistent language for the means of appeal throughout the code. The constitution of the board of appeals will be addressed in another change. There is some slight difference in the fire code in the section on limitations on authority and qualification where some differences given the scope of the code are appropriate to remain. The IPMC includes an additional section for stays of enforcement. The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

SECTION 113

MEANS OF APPEALS

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is

proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

[A] 113.4 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial proposal with no change to construction requirements.

ADM40-19 Part V

Public Hearing Results

Errata: This proposal includes published errata
Added a proponent to the code change.

Committee Action:

As Submitted

Committee Reason: This proposal brings consistency to the IgCC with regards to the appeals process as it is addressed in other codes. (Vote: 5-0)

Assembly Action:

None

ADM40-19 Part V

ADM43-19 Part II

IRC@: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), A101.3 (New), A101.3.1 (New), A101.3.2 (New), A101.3.3 (New), A101.3.4 (New), A101.3.5 (New), A101.3.6 (New), A101.3.7 (New), A101.3.8 (New), A101.4 (New), A101.5 (New), A101.5.1 (New), A101.5.2 (New), A101.5.3 (New), A101.6 (New), A101.7 (New), A101.7.1 (New), A101.7.2 (New), A101.8 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Residential Code

Add new text as follows:

APPENDIX A **BOARD OF APPEALS**

SECTION A101 **GENERAL**

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section R112 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the building official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the building official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The building official shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the building official by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the building official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the building official.

A101.7.2 Administration. The building official shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

Reason: The intent of this proposal is to have a consistent set of requirements for the Board of Appeals. The right for someone to have an appeal is addressed in a separate proposal for Means of Appeals. Currently the IBC and IFC have these requirements in an appendix, while other codes either don't have it at all or have it in the text. It was felt that appendix was a more appropriate place to allow for the jurisdiction to establish their own criteria, or to use this appendix as a template.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

APPENDIX A

BOARD OF APPEALS

SECTION A101

GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section XXX (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the *code official* pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the *code official* to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the *code official* within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The *code official* shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority may appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *code official* and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the *code official* by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *code official* within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *code official*.

A101.7.2 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is an editorial correlation and an option for jurisdictions to follow.

ADM43-19 Part II

Public Hearing Results

Errata: This proposal includes published errata. Added proponent to the code change.

Committee Action:

Disapproved

Committee Reason: The appendix contains too much detail for most jurisdictions. The Board of Appeals is handled differently in different jurisdictions. This information on the Board of Appeals is not needed in the IRC. (Vote: 10-1).

Assembly Action:

None

ADM43-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Submitted

Commenter's Reason: The main intent of the BCAC Administrative proposals for ICC to be considered a family of codes. ADM40 Part 1 and Part 3 were approved as submitted, therefore, this Appendix for the Board of Appeals will be in multiple codes.

In regards to the IRC provisions, ADM 40 Part 2 and ADM 43 Part 2 were intended to work together. The provisions currently in the IRC Section R112 (ADM 40 Part 2) are specific to customers having a means to appeal. The requirements for an actual Board of Appeals is provided in an appendix (ADM 43 Part 2) to provide guidance for a jurisdiction that might need this. The jurisdiction has the ability to make any modifications they feel are appropriate or use another model.

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-techsupport/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial correlation and an option for jurisdictions to follow.

Public Comment# 1239

ADM43-19 Part IV

IECC: Appendix RA (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Add new text as follows:

APPENDIX RA **BOARD OF APPEALS-RESIDENTIAL**

SECTION RA101 **GENERAL**

RA101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section R109 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

RA101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

RA101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

RA101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

RA101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

RA101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

RA101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

RA101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

RA101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

RA101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

RA101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

RA101.3.7 Compensation of members. Compensation of members shall be determined by law.

RA101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

RA101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

RA101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

RA101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

RA101.5.2 Quorum. Three members of the board shall constitute a quorum.

RA101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

RA101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

RA101.7 Board decision. The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

RA101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

RA101.7.2 Administration. The code official shall take immediate action in accordance with the decision of the board.

RA101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

Reason: The intent of this proposal is to have a consistent set of requirements for the Board of Appeals. The right for someone to have an appeal is addressed in a separate proposal for Means of Appeals. Currently the IBC and IFC have these requirements in an appendix, while other codes either don't have it at all or have it in the text. It was felt that appendix was a more appropriate place to allow for the jurisdiction to establish their own criteria, or to use this appendix as a template.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

APPENDIX A

BOARD OF APPEALS

SECTION A101

GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section XXX (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the *code official* pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the *code official* to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the *code official* within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The *code official* shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority may appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *code official* and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the *code official* by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *code official* within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *code official*.

A101.7.2 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial correlation and an option for jurisdictions to follow.

ADM43-19 Part IV

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is unnecessary (Vote: 11-0).

Assembly Action:

None

ADM43-19 Part IV

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Submitted

Commenter's Reason: The main intent of the BCAC Administrative proposals for ICC to be considered a family of codes. ADM40 Part 1 and Part 3 were approved as submitted, therefore, this Appendix for the Board of Appeals will be in multiple codes, including the Commercial portion of the Energy Code.

In regards to the IRC provisions, ADM 40 Part 2 and ADM 43 Part 2 were intended to work together. The provisions currently in the IRC Section R112 (ADM 40 Part 2) are specific to customers having a means to appeal. The requirements for an actual Board of Appeals is provided in an appendix (ADM 43 Part 2) to provide guidance for a jurisdiction that might need this. The jurisdiction has the ability to make any modifications they feel are appropriate or use another model.

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to

sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an editorial correlation and an option for jurisdictions to follow.

Public Comment# 1240

NOTE: ADM43-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM43-19 Part I

IBC®: APPENDIX B, SECTION B101, [A] B101.1, B101.1 (New), B101.2 (New), B101.2.1 (New), [A] B101.3, [A] B101.3.1, [A] B101.3.2, B101.3.3 (New), [A] B101.3.4, [A] B101.3.5, [A] B101.3.6, [A] B101.3.7, B101.3.8 (New), [A] B101.4, [A] B101.5, [A] B101.5.1, B101.5.2 (New), [A] B101.5.3, B101.6 (New), [A] B101.7, [A] B101.7.1, [A] B101.7.2, B101.8 (New); IEBC®: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), A101.3 (New), A101.3.1 (New), A101.3.2 (New), A101.3.3 (New), A101.3.4 (New), A101.3.5 (New), A101.3.6 (New), A101.3.7 (New), A101.3.8 (New), A101.4 (New), A101.5 (New), A101.5.1 (New), A101.5.2 (New), A101.5.3 (New), A101.6 (New), A101.7 (New), A101.7.1 (New), A101.7.2 (New), A101.8 (New); IFC®: APPENDIX A, SECTION A101, A101.1, A101.2 (New), A101.2.1 (New), A102.2.2 (New), A101.2, A101.2.1, A101.2.2, A101.2.3, A101.2.4, A101.2.5, A101.3, A101.3.1, A101.3.1 (New), A101.3.2 (New), A101.3.3, A101.3.4 (New), A101.3.5, A101.9, A101.3.6, A101.3.7 (New), A101.3.8, A101.4, A101.5, A101.5.1 (New), A101.5.2, A101.5.3 (New), A101.6, A101.7 (New), A101.7.1 (New), A101.7.2 (New), A101.8 (New); IFGC®: APPENDIX A (New), A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), [A] A101.3, [A] A101.3.1, [A] A101.3.2, A101.3.3 (New), [A] A101.3.4, [A] A101.3.5, [A] A101.3.6, [A] A101.3.7, A101.3.8 (New), [A] A101.4, [A] A101.5, [A] A101.5.1, A101.5.2 (New), [A] A101.5.3, A101.6 (New), [A] A101.7, [A] A101.7.1, [A] A101.7.2, [A] A101.8; IMC®: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), [A] A101.3, [A] A101.3.1, [A] A101.3.2, A101.3.3, [A] A101.3.4, [A] A101.3.5, [A] A101.3.6, [A] A101.3.7, A101.3.8 (New), [A] A101.4, [A] A101.5, [A] A101.5.1, A101.5.2 (New), [A] A101.5.3, A101.6 (New), [A] A101.7, [A] A101.7.1, [A] A101.7.2, [A] A101.8; IPC®: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), A101.3, A101.3.1, A101.3.2, A101.3.3 (New), A101.3.4, A101.3.5, A101.3.6, A101.3.7, A101.3.8 (New), A101.4, A101.5, A101.5.1, A101.5.2 (New), A101.5.3, A101.6 (New), A101.7, A101.7.1, A101.7.2, A101.8; IPSC®: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), [A] A101.3, [A] A101.3.1, [A] A101.3.2, A101.3.3 (New), [A] A101.3.4, [A] A101.3.5, [A] A101.3.6, [A] A101.3.7, A101.3.8 (New), [A] A101.4, [A] A101.5, [A] A101.5.1, A101.5.2 (New), [A] A101.5.3, A101.6 (New), [A] A101.7, [A] A101.7.1, [A] A101.7.2, [A] A101.8; IPMC®: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), [A] A101.2.2, [A] A101.3, A101.3.1 (New), [A] A101.3.2, A101.3.3 (New), [A] A101.3.4, [A] A101.3.5, [A] A101.3.6, [A] A101.3.7, A101.3.8 (New), [A] A101.4, [A] A101.5, [A] A101.5.1, A101.5.2 (New), [A] A101.5.3, A101.6 (New), [A] A101.7, [A] A101.7.1, [A] A101.7.2, [A] A101.8; ISPSC®: APPENDIX A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), [A] A101.3, [A] A101.3.1, [A] A101.3.2, A101.3.3 (New), [A] A101.3.4, [A] A101.3.5, [A] A101.3.6, [A] A101.3.7, A101.3.8 (New), [A] A101.4, [A] A101.5, [A] A101.5.1, A101.5.2 (New), [A] A101.5.3, A101.6 (New), [A] A101.7, [A] A101.7.1, [A] A101.7.2, [A] A101.8; IWUIC®: SECTION 106, [A] 106.1, A (New), SECTION A101 (New), A101.1 (New), A101.2 (New), A101.2.1 (New), A101.2.2 (New), A101.3 (New), A101.3.1 (New), A101.3.2 (New), A101.3.3 (New), A101.3.4 (New), A101.3.5 (New), A101.3.6 (New), A101.3.7 (New), A101.3.8 (New), A101.4 (New), A101.5 (New), A101.5.1 (New), A101.5.2 (New), A101.5.3 (New), A101.6 (New), A101.7 (New), A101.7.1 (New), A101.7.2 (New), A101.8 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

THIS IS A 4 PART CODE CHANGE. PART I WILL BE HEARD BY THE ADMINISTRATIVE CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING CODE COMMITTEE. PART III WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. PART IV WILL BE HEARD BY THE IECC-RESIDENTIAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Building Code

APPENDIX B BOARD OF APPEALS

Revise as follows:

SECTION B101 GENERAL

Delete without substitution:

~~[A] B101.1 Application. Applications for appeal shall be obtained from the building official. Applications shall be filed within 20 days after notice has been served.~~

Add new text as follows:

B101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 113 (Means of Appeals). The board shall be established and operated in

accordance with this section, and shall be authorized to hear evidence from appellants and the building official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

B101.2 Application for appeal. Any person shall have the right to appeal a decision of the building official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the building official within 20 days after the notice was served.

B101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

B101.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Revise as follows:

[A] ~~B401.2~~ B101.3 Membership of board. The board of appeals shall consist of ~~persons~~ five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board. ~~as follows:~~

- ~~1. One for 5 years; one for 4 years; one for 3 years; one for 2 years; and one for 1 year.~~
- ~~2. Thereafter, each new member shall serve for 5 years or until a successor has been appointed.~~

~~The building official shall be an ex officio member of said board but shall have no vote on any matter before the board.~~

[A] ~~B401.2.2~~ B101.3.1 Qualifications. The board of appeals shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction ~~one from each of the following professions or disciplines:~~

- ~~1. Registered design professional with architectural experience or a builder or superintendent of building construction with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~
- ~~2. Registered design professional with structural engineering experience.~~
- ~~3. Registered design professional with mechanical and plumbing engineering experience or a mechanical contractor with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~
- ~~4. Registered design professional with electrical engineering experience or an electrical contractor with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~
- ~~5. Registered design professional with fire protection engineering experience or a fire protection contractor with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~

[A] ~~B401.2.1~~ B101.3.2 Alternate members. The chief appointing authority ~~shall~~ is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for 5 years, ~~the same term~~ or until a successor has been appointed.

Add new text as follows:

B101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

Revise as follows:

[A] ~~B401.2.4~~ B101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

[A] ~~B401.2.6~~ B101.3.5 Secretary. The chief ~~administrative officer~~ appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] ~~B401.2.5~~ B101.3.6 Disqualification-Conflict of member; interest. A member ~~shall not hear an appeal in which that member has a~~ with any personal, professional or financial interest ~~interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.~~

[A] ~~B401.2.7~~ B101.3.7 Compensation of members. Compensation of members shall be determined by law.

Add new text as follows:

B101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

[A] ~~B401.2.3~~ B101.4 Rules and procedures. The board ~~is authorized to~~ shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

~~[A] B401.3 B101.5 Notice of meeting.~~ The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic meetings.

~~[A] B401.3.1 B101.5.1 Open hearing.~~ All hearings before the board shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

Add new text as follows:

B101.5.2 Quorum. Three members of the board shall constitute a quorum.

Delete without substitution:

~~[A] B401.3.2 Procedure.~~ The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be received.

Revise as follows:

~~[A] B401.3.3 B101.5.3 Postponed hearing.~~ When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

B101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

~~[A] B401.4 B101.7 Board decision.~~ The board shall modify or reverse the decision of the *building official* by a concurring vote of two-thirds of its members. ~~The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.~~

~~[A] B401.4.1 B101.7.1 Resolution.~~ The decision of the board shall be by resolution. ~~Certified copies shall be~~ Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *building code official*.

~~[A] B401.4.2 B101.7.2 Administration.~~ The *building official* shall take immediate action in accordance with the decision of the board.

Add new text as follows:

B101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Existing Building Code

Add new text as follows:

APPENDIX A **BOARD OF APPEALS**

SECTION A101 **GENERAL**

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 112. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each

member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

A101.7.2 Administration. The code official shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Fire Code

APPENDIX A BOARD OF APPEALS

Revise as follows:

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the

requirements of the International Fire Code ~~this code~~ pursuant to the provisions of Section ~~108 of the International Fire Code~~ 109. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the fire code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

Add new text as follows:

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the fire code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the fire code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A102.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Delete without substitution:

~~A101.2 Membership.~~ ~~The membership of the board shall consist of five voting members having the qualifications established by this section. Members shall be nominated by the fire code official or the chief administrative officer of the jurisdiction, subject to confirmation by a majority vote of the governing body. Members shall serve without remuneration or compensation, and shall be removed from office prior to the end of their appointed terms only for cause.~~

~~A101.2.1 Design professional.~~ ~~One member shall be a practicing design professional registered in the practice of engineering or architecture in the state in which the board is established.~~

~~A101.2.2 Fire protection engineering professional.~~ ~~One member shall be a qualified engineer, technologist, technician or safety professional trained in fire protection engineering, fire science or fire technology. Qualified representatives in this category shall include fire protection contractors and certified technicians engaged in fire protection system design.~~

~~A101.2.3 Industrial safety professional.~~ ~~One member shall be a registered industrial or chemical engineer, certified hygienist, certified safety professional, certified hazardous materials manager or comparably qualified specialist experienced in chemical process safety or industrial safety.~~

~~A101.2.4 General contractor.~~ ~~One member shall be a contractor regularly engaged in the construction, alteration, maintenance, repair or remodeling of buildings or building services and systems regulated by the code.~~

~~A101.2.5 General industry or business representative.~~ ~~One member shall be a representative of business or industry not represented by a member from one of the other categories of board members described in Sections A101.2.1 through A101.2.4.~~

Revise as follows:

A101.3 Terms Membership of office: board. Members shall be appointed for terms of 4 years. Members shall not be reappointed to serve more than two consecutive full terms.

The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The fire code official shall be an ex officio member of said board but shall not vote on any matter before the board.

Delete without substitution:

~~A101.3.1 Initial appointments.~~ ~~Of the members first appointed, two shall be appointed for a term of 1 year, two for a term of 2 years, one for a term of 3 years.~~

Add new text as follows:

A101.3.1 Qualifications. The board shall consist of members who are qualified by experience and training to pass on matters pertaining to hazards of fire, explosions, hazardous conditions or fire protection systems, and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

Revise as follows:

A101.3.2 A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made. Members appointed to fill a vacancy in an unexpired term shall be eligible for reappointment to two full terms.

Add new text as follows:

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

Revise as follows:

~~**A101-5**~~ **A101.3.5 Secretary of board.** The ~~fire code official shall act as secretary of the board and shall keep~~ chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all its proceedings, which shall set forth the reasons for ~~its decisions~~ the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

Delete without substitution:

~~**A101-9 Decisions.** Every decision shall be promptly filed in writing in the office of the fire code official and shall be open to public inspection. A certified copy shall be sent by mail or otherwise to the appellant, and a copy shall be kept publicly posted in the office of the fire code official for 2 weeks after filing.~~

Revise as follows:

~~**A101-8**~~ **A101.3.6 Conflict of interest.** ~~Members with a material~~ A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

Add new text as follows:

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

Revise as follows:

~~**A101-3-3**~~ **A101.3.8 Removal from office the board.** ~~Members~~ A member shall be removed from ~~office the board~~ prior to the end of their terms only for ~~cause. Continued absence of any member~~ cause. Any member with continued absence from regular ~~meetings~~ meeting of the board shall ~~may be removed~~ at the discretion of the ~~applicable governing body~~, ~~render any such member liable to immediate removal from office.~~ chief appointing authority.

~~**A101-10**~~ **A101.4 Procedures, Rules and procedures.** The board shall be operated in accordance with the Administrative Procedures Act of the state in which it is established or shall establish rules and regulations for its own procedure not inconsistent establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

~~**A101-7**~~ **A101.5 Meetings, Notice of meetings.** The board shall meet at regular intervals, to be determined by the chairman. In any event, the board shall meet upon notice from the chairperson, within 10 days ~~after notice of appeal has been received. the filing of an appeal or at stated~~ periodic intervals.

Add new text as follows:

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the fire code official and any person whose interests are affected shall be given an opportunity to be heard.

Revise as follows:

~~**A101-4**~~ **A101.5.2 Quorum.** Three members of the board shall constitute a quorum. ~~In varying the application of any provisions of this code or in modifying an order of the fire code official, affirmative votes of the majority present, but not less than three, shall be required.~~

Add new text as follows:

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Revise as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for ~~consideration~~ consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Add new text as follows:

A101.7 Board decision. The board shall only modify or reverse the decision of the fire code official by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the fire code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the fire code official.

A101.7.2 Administration. The fire code official shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the

2018 International Fuel Gas Code

Add new text as follows:

APPENDIX A BOARD OF APPEALS

A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 109 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Revise as follows:

[A] ~~109.2~~ A101.3 Membership of board. The board of appeals shall consist of five voting members appointed by the chief appointing authority as follows: one for 5 years; one for 4 years; one for 3 years; one for 2 years and one for 1 year. Thereafter, each new of the jurisdiction. Each member shall serve for 5 [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

[A] ~~109.2.1~~ A101.3.1 Qualifications. The board of appeals shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction, one from each of the following professions or disciplines:

1. Registered design professional who is a registered architect; or a builder or superintendent of building construction with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.
2. Registered design professional with structural engineering or architectural experience.
3. Registered design professional with fuel gas and plumbing engineering experience; or a fuel gas contractor with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.
4. Registered design professional with electrical engineering experience; or an electrical contractor with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.
5. Registered design professional with fire protection engineering experience; or a fire protection contractor with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.

[A] ~~109.2.2~~ A101.3.2 Alternate members. The chief appointing authority shall be authorized to appoint two alternate members who shall be called by the board chairman-chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for 5 years, the same term or until a successor has been appointed.

Add new text as follows:

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

Revise as follows:

[A] ~~109.2.3~~ A101.3.4 Chairman- Chairperson. The board shall annually select one of its members to serve as chairman-chairperson.

[A] ~~109.2.5~~ A101.3.5 Secretary. The chief administrative officer-appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] ~~109.2.4~~ A101.3.6 Disqualification Conflict of member- interest. A member shall not hear an appeal in which that member has a with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] ~~109.2.6~~ A101.3.7 Compensation of members. Compensation of members shall be determined by law.

Add new text as follows:

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

~~[A] **109-4.1 A101.4 Procedure, Rules and procedures.** The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted, establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law.~~ The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be ~~received;~~ presented.

~~[A] **109-3 A101.5 Notice of meeting.** The board shall meet upon notice from the chairman~~ **chairperson**, within 10 days of the filing of an appeal –or at stated periodic ~~meetings;~~ intervals.

Add new text as follows:

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

Revise as follows:

~~[A] **109-5 A101.5.3 Postponed hearing.** Where~~ **When** five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

~~[A] **109-6 A101.7 Board decision.** The board shall~~ **only** modify or reverse the decision of the code official by a concurring vote of three **or more** members.

~~[A] **109-6.1 A101.7.1 Resolution.** The decision of the board shall be by resolution. Certified copies shall be~~ **Every** decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant **or the appellant's representative** and to the code official.

~~[A] **109-6.2 A101.7.2 Administration.** The code official shall take immediate action in accordance with the decision of the board.~~

~~[A] **109-7 A101.8 Court review.** Any person, whether or not a previous party to~~ **of** the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Mechanical Code

Add new text as follows:

APPENDIX A BOARD OF APPEALS

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 109 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Revise as follows:

[A] ~~409-2~~ A101.3 Membership of board. The board of appeals shall consist of five voting members appointed by the chief appointing authority as follows: one for 5 years; one for 4 years; one for 3 years; one for 2 years; and one for 1 year. Thereafter, each new of the jurisdiction. Each member shall serve for 5 [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

[A] ~~409-2.1~~ A101.3.1 Qualifications. The board of appeals shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction, one from each of the following professions or disciplines:

1. *Registered design professional* who is a registered architect; or a builder or superintendent of building construction with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.
2. *Registered design professional* with structural engineering or architectural experience.
3. *Registered design professional* with mechanical and plumbing engineering experience; or a mechanical contractor with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.
4. *Registered design professional* with electrical engineering experience; or an electrical contractor with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.
5. *Registered design professional* with fire protection engineering experience; or a fire protection contractor with not less than 10 years' experience, 5 of which shall have been in responsible charge of work.

[A] ~~409-2.2~~ A101.3.2 Alternate members. The chief appointing authority shall is authorized to appoint two alternate members who shall be called by the board chairman chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for 5 years, the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

[A] ~~409-2.3~~ A101.3.4 Chairman. Chairperson. The board shall annually select one of its members to serve as chairman chairperson.

[A] ~~409-2.5~~ A101.3.5 Secretary. The chief administrative officer appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] ~~409-2.4~~ A101.3.6 Disqualification Conflict of member. interest. A member shall not hear an appeal in which that member has a with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] ~~409-2.6~~ A101.3.7 Compensation of members. Compensation of members shall be determined by law.

Add new text as follows:

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

[A] ~~409-4.1~~ A101.4 Procedure. Rules and procedures. The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be received. presented.

[A] ~~409-3~~ A101.5 Notice of meeting. The board shall meet upon notice from the chairman chairperson, within 10 days of the filing of an appeal, or at stated periodic meetings intervals.

Add new text as follows:

[A] A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

Revise as follows:

[A] ~~409-5~~ A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

[A] ~~109.6.1~~ **A101.7 Board decision.** The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

[A] ~~109.6.1~~ **A101.7.1 Resolution.** The decision of the board shall be by resolution. ~~Certified copies shall be~~ Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

[A] ~~109.6.2~~ **A101.7.2 Administration.** The code official shall take immediate action in accordance with the decision of the board.

[A] ~~109.7~~ **A101.8 Court review.** Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Plumbing Code

Add new text as follows:

APPENDIX A BOARD OF APPEALS

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section XXX (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Revise as follows:

~~109.2~~ **A101.3 Membership of board.** The board of appeals shall consist of five voting members appointed by the chief appointing authority ~~as follows: one for 5 years, one for 4 years, one for 3 years, one for 2 years and one for 1 year. Thereafter, each new~~ of the jurisdiction. Each member shall serve for 5 [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

~~109.2.1~~ **A101.3.1 Qualifications.** The board of appeals shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction, one from each of the following professions or disciplines:

- ~~1. Registered design professional who is a registered architect; or a builder or superintendent of building construction with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~
- ~~2. Registered design professional with structural engineering or architectural experience.~~
- ~~3. Registered design professional with mechanical and plumbing engineering experience; or a mechanical and plumbing contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~
- ~~4. Registered design professional with electrical engineering experience; or an electrical contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~
- ~~5. Registered design professional with fire protection engineering experience; or a fire protection contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~

~~109.2.2~~ **A101.3.2 Alternate members.** The chief appointing authority ~~shall~~ is authorized to appoint two alternate members who shall be called by the board ~~chairman~~ chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for ~~5 years~~ the same term or until a successor has been appointed.

Add new text as follows:

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

Revise as follows:

~~109-2.3~~ **A101.3.4 Chairman- Chairperson.** The board shall annually select one of its members to serve as ~~chairman~~ chairperson.

~~109-2.5~~ **A101.3.5 Secretary.** The chief administrative officer appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings ~~in the office of the chief administrative officer,~~ which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

~~109-2.4~~ **A101.3.6 Disqualification-Conflict of member- interest.** A member ~~shall not hear an appeal in which that member has with~~ any personal, professional or financial ~~interest- interest~~ in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

~~109-2.6~~ **A101.3.7 Compensation of members.** Compensation of members shall be determined by law.

Add new text as follows:

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

~~109-4.1~~ **A101.4 Procedure. Rules and procedures.** The board shall ~~adopt and make available to the public through the secretary procedures under which a hearing will be conducted,~~ establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be ~~received- presented.~~

~~109-3~~ **A101.5 Notice of meeting.** The board shall meet upon notice from the ~~chairman~~ chairperson, within 10 days of the filing of an appeal or at stated periodic ~~meetings- intervals.~~

~~109-4~~ **A101.5.1 Open hearing. Hearings-All hearings** before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

Add new text as follows:

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

Revise as follows:

~~109-5~~ **A101.5.3 Postponed hearing.** When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

~~109-6~~ **A101.7 Board decision.** The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

~~109-6.1~~ **A101.7.1 Resolution.** The decision of the board shall be by resolution. ~~Certified copies shall be~~ Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

~~109-6.2~~ **A101.7.2 Administration.** The code official shall take immediate action in accordance with the decision of the board.

~~109-7~~ **A101.8 Court review.** Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Private Sewage Disposal Code

Add new text as follows:

APPENDIX A BOARD OF APPEALS

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 109 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Revise as follows:

[A] ~~109-2~~ A101.3 Membership of board. The board of appeals shall consist of five voting members appointed by the chief appointing authority as follows: one for 5 years, one for 4 years, one for 3 years, one for 2 years and one for 1 year. Thereafter, each new of the jurisdiction. Each member shall serve for 5 [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

[A] ~~109-2.1~~ A101.3.1 Qualifications. The board of appeals shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction, one from each of the following professions or disciplines-

1. Registered design professional who is a registered architect; or a builder or superintendent of building construction with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.
2. Registered design professional with structural engineering or architectural experience.
3. Registered design professional with mechanical and plumbing engineering experience; or a mechanical and plumbing contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.
4. Registered design professional with electrical engineering experience; or an electrical contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.
5. Registered design professional with fire protection engineering experience; or a fire protection contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.

[A] ~~109-2.2~~ A101.3.2 Alternate members. The chief appointing authority shall be authorized to appoint two alternate members who shall be called by the board chairman-chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for 5 years the same term or until a successor has been appointed.

Add new text as follows:

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

Revise as follows:

[A] ~~109-2.3~~ A101.3.4 Chairman- Chairperson. The board shall annually select one of its members to serve as chairman-chairperson.

[A] ~~109-2.5~~ A101.3.5 Secretary. The chief administrative officer-appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] ~~109-2.4~~ A101.3.6 Disqualification Conflict of a member- Interest. A member shall not hear an appeal in which that member has with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] ~~109-2.6~~ A101.3.7 Compensation of members. Compensation of members shall be determined by law.

Add new text as follows:

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

~~[A] 109.4.1 A101.4 Procedure. Rules and procedures.~~ The board shall ~~adopt and make available to the public through the secretary procedures under which a hearing will be conducted.~~ establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be ~~received.~~ presented.

~~[A] 109.3 A101.5 Notice of meeting.~~ The board shall meet upon notice from the ~~chairman~~ chairperson, within 10 days of the filing of an appeal or at stated periodic ~~meetings.~~ intervals.

Add new text as follows:

[A] A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

Revise as follows:

~~[A] 109.5 A101.5.3 Postponed hearing.~~ When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

~~[A] 109.6 A101.7 Board decision.~~ The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

~~[A] 109.6.1 A101.7.1 Resolution.~~ The decision of the board shall be by resolution. ~~Certified copies shall be~~ Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

~~[A] 109.6.2 A101.7.2 Administration.~~ The code official shall take immediate action in accordance with the decision of the board.

~~[A] 109.7 A101.8 Court review.~~ Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Property Maintenance Code

Add new text as follows:

APPENDIX A BOARD OF APPEALS

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 111 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

Revise as follows:

~~[A] 111.8 A101.2.2 Stays of enforcement.~~ Appeals of notice and orders ~~(other, other than Imminent Danger notices)~~ notices, shall stay the enforcement of the notice and order until the appeal is heard by the ~~appeals~~ board.

~~[A] 111.2 A101.3 Membership of board.~~ The board of appeals shall consist of ~~not less than three members who are qualified by experience and~~

~~training to pass on matters pertaining to property maintenance and who are not employees of the jurisdiction. The five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ~~ex officio~~ ~~ex officio~~ member of said board but shall not vote on any matter before the board. ~~The board shall be appointed by the chief appointing authority, and shall serve staggered and overlapping terms.~~~~

Add new text as follows:

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

Revise as follows:

[A] ~~411.2.1~~ **A101.3.2 Alternate members.** The chief appointing authority ~~shall appoint not less than~~ is authorized to appoint two alternate members who shall be called by the board ~~chairman~~ chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board ~~membership~~ membership, and shall be appointed for the same term or until a successor has been appointed.

Add new text as follows:

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

Revise as follows:

[A] ~~411.2.2~~ **A101.3.4 Chairman. Chairperson.** The board shall annually select one of its members to serve as ~~chairman~~ chairperson.

[A] ~~411.2.4~~ **A101.3.5 Secretary.** The chief ~~administrative officer~~ appointing authority shall designate a qualified ~~person~~ clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings ~~in the office of the chief administrative officer, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.~~

[A] ~~411.2.3~~ **A101.3.6 Disqualification Conflict of member interest.** A member ~~shall not hear an appeal in which that member has a~~ with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] ~~411.2.5~~ **A101.3.7 Compensation of members.** Compensation of members shall be determined by law.

Add new text as follows:

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

[A] ~~411.4.1~~ **A101.4 Procedure. Rules and procedures.** The board shall ~~adopt and make available to the public through the secretary~~ procedures under which a hearing will be conducted. establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be ~~received~~ presented.

[A] ~~411.3~~ **A101.5 Notice of meeting.** The board shall meet upon notice from the ~~chairman~~ chairperson, within ~~20~~ 10 days of the filing of an appeal, or at stated periodic ~~meetings~~ intervals.

Add new text as follows:

[A] **A101.5.1 Open hearing.** All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

Revise as follows:

[A] ~~411.5~~ **A101.5.3 Postponed hearing.** When ~~the full board is~~ five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

~~[A] 411.6 A101.7 Board decision.~~ The board shall only modify or reverse the decision of the code official ~~only~~ by a concurring vote of ~~a majority of the total number of appointed board three or more~~ members.

~~[A] 411.6.1 A101.7.1 Records and copies- Resolution.~~ The decision of the board shall be ~~recorded.~~ Copies shall be by resolution. Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

~~[A] 411.6.2 A101.7.2 Administration.~~ The code official shall take immediate action in accordance with the decision of the board.

~~[A] 411.7 A101.8 Court review.~~ Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Swimming Pool and Spa Code

Add new text as follows:

APPENDIX A BOARD OF APPEALS

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 108 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

Revise as follows:

~~[A] 408.2 A101.3 Membership of board.~~ The board ~~of appeals~~ shall consist of five voting members appointed by the chief appointing authority ~~as follows: one for 5 years, one for 4 years, one for 3 years, one for 2 years and one for 1 year. Thereafter, each new~~ of the jurisdiction. Each member shall serve for 5 [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

~~[A] 408.2.1 A101.3.1 Qualifications.~~ The board ~~of appeals~~ shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction, one from each of the following professions or disciplines:

- ~~1. Registered design professional who is a registered architect; or a builder or superintendent of building construction with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~
- ~~2. Registered design professional with structural engineering or architectural experience.~~
- ~~3. Registered design professional with mechanical and plumbing engineering experience; or a mechanical and plumbing contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~
- ~~4. Registered design professional with electrical engineering experience; or an electrical contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~
- ~~5. Registered design professional with pool or spa experience; or a contractor with not less than 10 years' experience, 5 years of which shall have been in responsible charge of work.~~

~~[A] 408.2.2 A101.3.2 Alternate members.~~ The chief appointing authority ~~shall~~ is authorized to appoint two alternate members who shall be called by the board ~~chairman~~ chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for 5 years the same term or until a successor has been appointed.

Add new text as follows:

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

Revise as follows:

~~[A] 408.2.3 A101.3.4 Chairman- Chairperson.~~ The board shall annually select one of its members to serve as ~~chairman-~~ chairperson.

[A] ~~108-2.5~~ **A101.3.5 Secretary.** The chief ~~administrative officer appointing authority~~ shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] ~~108-2.4~~ **A101.3.6 Disqualification-Conflict of member- interest.** A member ~~shall not hear an appeal in which that member has with any personal, professional or financial interest.~~ interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] ~~108-2.6~~ **A101.3.7 Compensation of members.** Compensation of members shall be determined by law.

Add new text as follows:

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

Revise as follows:

[A] ~~108-4.1~~ **A101.4 Procedure- Rules and procedures.** The board shall ~~adopt and make available to the public through the secretary procedures under which a hearing will be conducted.~~ establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be ~~received.~~ presented.

[A] ~~108-3~~ **A101.5 Notice of meeting.** The board shall meet upon notice from the ~~chairman~~ chairperson, within 10 days of the filing of an appeal or at stated periodic ~~meetings.~~ intervals.

[A] ~~108-4~~ **A101.5.1 Open hearing.** ~~Hearings-~~ All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

Add new text as follows:

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

Revise as follows:

[A] ~~108-5~~ **A101.5.3 Postponed hearing.** When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

Add new text as follows:

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

Revise as follows:

[A] ~~108-6~~ **A101.7 Board decision.** The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

[A] ~~108-6.1~~ **A101.7.1 Resolution.** The decision of the board shall be by resolution. ~~Certified copies shall be-~~ Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

[A] ~~108-6.2~~ **A101.7.2 Administration.** The code official shall take immediate action in accordance with the decision of the board.

[A] ~~108-7~~ **A101.8 Court review.** Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

2018 International Wildland-Urban Interface Code

Revise as follows:

SECTION 106 APPEALS

[A] **106.1 General.** ~~To determine the suitability of alternative materials and methods and to provide for reasonable interpretations of the provisions of this code, there shall be and hereby is created a board of appeals consisting of five members who are qualified by experience and training to pass judgment on pertinent matters.-The code official, building official and fire chief shall be ex officio members, and the code official shall act as secretary of the board. The board of appeals shall be appointed by the legislative body and shall hold office at their discretion. The board shall adopt~~

reasonable rules and regulations for conducting its investigations and shall render decisions and findings in writing to the code official, with a duplicate copy to the applicant.

Add new text as follows:

A **BOARD OF APPEALS**

SECTION A101 **GENERAL**

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 106 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the building official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

A101.7.2 Administration. The code official shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

Reason: The intent of this proposal is to have a consistent set of requirements for the Board of Appeals. The right for someone to have an appeal is addressed in a separate proposal for Means of Appeals. Currently the IBC and IFC have these requirements in an appendix, while other codes either don't have it at all or have it in the text. It was felt that appendix was a more appropriate place to allow for the jurisdiction to establish their own criteria, or to use this appendix as a template.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

APPENDIX A

BOARD OF APPEALS

SECTION A101

GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section XXX (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the *code official* pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the *code official* to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the *code official* within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The *code official* shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority may appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership,

and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *code official* and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the *code official* by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *code official* within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *code official*.

A101.7.2 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and

debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial correlation and an option for jurisdictions to follow.

ADM43-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

As Submitted

Committee Reason: The committee stated that the reasons for the approval of the proposal were that it standardizes the language across the I-Codes, it provides another tool and it gives appropriate guidance as an appendix to establish a board of appeals. (Vote: 13-0)

Assembly Action:

None

ADM43-19 Part I

NOTE: ADM43-19 PART III DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

ADM43-19 Part III

IECC@: APPENDIX CA (New), SECTION CA101 (New), CA101.1 (New), CA101.2 (New), CA101.2.1 (New), CA101.2.2 (New), CA101.3 (New), CA101.3.1 (New), CA101.3.2 (New), CA101.3.3 (New), CA101.3.4 (New), CA101.3.5 (New), CA101.3.6 (New), CA101.3.7 (New), CA101.3.8 (New), CA101.4 (New), CA101.5 (New), CA101.5.1 (New), CA101.5.2 (New), CA101.5.3 (New), CA101.6 (New), CA101.7 (New), CA101.7.1 (New), CA101.7.2 (New), CA101.8 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Pennie Feehan, representing Plumbing, Mechanical, and Fuel Gas Code Action Committee (pmgcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Energy Conservation Code

Add new text as follows:

APPENDIX CA **BOARD OF APPEALS-COMMERCIAL**

SECTION CA101 **GENERAL**

CA101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section C109 (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

CA101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

CA101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

CA101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

CA101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

CA101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

CA101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

CA101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

CA101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

CA101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

CA101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

CA101.3.7 Compensation of members. Compensation of members shall be determined by law.

CA101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

CA101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

CA101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

CA101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

CA101.5.2 Quorum. Three members of the board shall constitute a quorum.

CA101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

CA101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

CA101.7 Board decision. The board shall only modify or reverse the decision of the code official by a concurring vote of three or more members.

CA101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

CA101.7.2 Administration. The code official shall take immediate action in accordance with the decision of the board.

CA101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

Reason: The intent of this proposal is to have a consistent set of requirements for the Board of Appeals. The right for someone to have an appeal is addressed in a separate proposal for Means of Appeals. Currently the IBC and IFC have these requirements in an appendix, while other codes either don't have it at all or have it in the text. It was felt that appendix was a more appropriate place to allow for the jurisdiction to establish their own criteria, or to use this appendix as a template.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals."

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as "building/fire/code official".

APPENDIX A

BOARD OF APPEALS

SECTION A101

GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section XXX (Means of Appeals). The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the *code official* pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the *code official* to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code

do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the *code official* within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The *code official* shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority may appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

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A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *code official* and any person whose interests are affected shall be given an opportunity to be heard.

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A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the *code official* by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *code official* within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *code official*.

A101.7.2 Administration. The *code official* shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC) and the ICC Plumbing/Mechanical/Gas Code Action Committee (PMG CAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

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The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

The PMG CAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance the International Codes or portions thereof that were under the purview of the PMG CAC. In 2017-2018, the PMG CAC held one face-to-face meeting and 11 conference call meetings. Numerous interested parties attended the committee meetings and offered their input. Related documentation and reports are posted on the PMGCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/pmg-code-action-committee-pmgcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial correlation and an option for jurisdictions to follow.

ADM43-19 Part III

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The appendix allows a jurisdiction to use this appendix on a Board of Appeals. It is optional, not a requirement. There was concern that not all of the parts of ADM43 have been accepted by the various committees. (Vote 11-3)

Assembly Action:

None

ADM43-19 Part III

ADM44-19

Appendix O (New)

Proposed Change as Submitted

Proponents: Gary Lewis, City of Summit NJ, representing City of Summit NJ (glewis@cityofsummit.org); Don Havener, representing Self (dhavener@cosentini.com); Raymond Grill, representing Self (ray.grill@arup.com)

2018 International Building Code

Add new text as follows:

APPENDIX O **PERFORMANCE-BASED APPLICATION**

O101.1 Introduction. The following administrative provisions are excerpted from the ICC Performance Code for Buildings and Facilities. These can be used in conjunction with the Alternate Methods provisions in Chapter 1, or for a review of submittals such as those in Section 909 or elsewhere requiring a rational analysis or performance-based design to provide a recognized framework for the code official in terms of the design expertise needed, the necessary submittals, a review framework and related items. While not every step is required in every instance, these model provisions serve as the starting point for the formulation of an effective submittal and corresponding thorough review.

O101.2 Qualifications. Registered design professionals shall possess the knowledge, skills and abilities necessary to demonstrate compliance with this code.

O101.3 Construction document preparation. Construction documents required by this code shall be prepared in adequate detail and submitted for review and approval in accordance with Section 107.

O101.3.1 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions in accordance with Section 107.

O101.4 Construction. Construction shall comply with the approved construction documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.1 Facility operating policies and procedures. Policies, operations, training and procedures shall comply with approved documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.2 Maintenance. Maintenance of the performance-based design shall be ensured throughout the life of the building or portion thereof.

O101.4.3 Changes. The owner or the owner's authorized agent shall be responsible to ensure that any change to the facility, process, or system does not increase the hazard level beyond that originally designed without approval and that changes shall be documented in accordance with the code.

O101.5 Documentation. The registered design professional shall prepare appropriate documentation for the project that clearly provides the design approach and rationale for design submittal, construction and future use of the building, facility or process.

O101.5.1 Reports and Manuals. The design report shall document the steps taken in the design analysis, clearly identifying the criteria, parameters, inputs, assumptions, sensitivities and limitations involved in the analysis. The design report shall clearly identify bounding conditions, assumptions and sensitivities that clarify the expected uses and limitations of the performance analysis. This report shall verify that the design approach is in compliance with the applicable codes and acceptable methods and shall be submitted for concurrence by the code official prior to the construction documents being completed. The report shall document the design features to be incorporated based on the analysis.

The design report shall address the following:

1. Project scope.
2. Goals and objectives.
3. Performance criteria.
4. Hazard scenarios.
5. Design fire loads and hazards.
6. Final design.
7. Evaluation.
8. Bounding conditions and critical design assumptions.
9. Critical design features.
10. System design and operational requirements.
11. Operational and maintenance requirements.
12. Commissioning testing requirements and acceptance criteria.
13. Frequency of certificate renewal.

- 14. Supporting documents and references.
- 15. Preliminary site and floor plans.

O101.5.2 Design Submittal. Applicable construction documents shall be submitted to the code official for review. The documents shall be submitted in accordance with the jurisdiction's procedures and in sufficient detail to obtain appropriate permits.

O101.6 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions.

O101.6.1 Peer review. The owner or the owner's authorized agent shall be responsible for retaining and furnishing the services of a registered design professional or recognized expert, who will perform as a peer reviewer, where required and approved by the code official.

O101.6.2 Costs. Costs. The costs of special services, including contract review, where required by the code official, shall be borne by the owner or the owner's authorized agent.

O101.7 Permits. Prior to the start of construction, appropriate permits shall be obtained in accordance with the jurisdiction's procedures and applicable codes.

O101.8 Verification of compliance. Upon completion of the project, documentation shall be prepared that verifies performance and prescriptive code provisions have been met. Where required by the code official, the registered design professional shall file a report that verifies bounding conditions are met.

O101.9 Extent of documentation. Approved construction documents, the operations and maintenance manual, inspection and testing records, and certificates of occupancy with conditions shall be included in the project documentation of the code official's records.

O101.10 Analysis of change. The registered design professional shall evaluate the existing building, facilities, premises, processes, contents and the applicable documentation of the proposed change as it affects portions of the building, facility, premises, processes and contents that were previously designed for compliance under a performance-based code. Prior to any change that was not documented in a previously approved design, the registered design professional shall examine the applicable design documents, bounding conditions, operation and maintenance manuals, and deed restrictions.

Reason: This proposal does not generate any new code requirements, but rather provides an optional design, review and approval framework for use by the code official. Typical uses would include cases of alternate methods in Chapter 1, select areas of the IBC that require a rational analysis such as Section 909 and elsewhere. The proposed Appendix simply extracts the relevant administrative provisions from the ICC Performance Code into a more concise, usable appendix format for a jurisdiction confronted with such a need. Currently there are multiple, varying jurisdictional rules and procedures in many communities regarding procedure and none in even more. The code official is often left alone to reach decisions not just on the merits of a design, but must first also decide on the submittal and review process.

As an Appendix, it is entirely optional to a jurisdiction. It can be adopted, adopted with local modifications, or even used on a case-by-case basis as part of a Memorandum of Understanding or similar legal agreement between the jurisdiction and the owner/design team. It simply represents another tool for the jurisdiction to reach for in cases of need; it neither encourages nor creates any additional opportunity for performance-based design.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

As this provision is an Appendix and, as such, remains optional to the jurisdiction, it imparts no new code requirements and, therefore, no new costs. In fact, by potentially addressing these administrative process issues at the outset, use of the Appendix could realistically result in cost savings.

ADM44-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The committee stated the reason for the approval of the proposal was that the addition of the appendix provides another option within the code and the previous action taken on ADM11-19. In opposition it was stated that there is a need for a timeline or qualification for the expert and that more work is needed. (Vote: 8-5)

Assembly Action:

None

ADM44-19

Individual Consideration Agenda

Public Comment 1:

IBC@: O101.1

Proponents:

Gary Lewis, representing Self (glewis@cityofsummit.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

O101.1 Introduction. The following administrative provisions are excerpted from the ICC Performance Code for Buildings and Facilities. ~~These and can be used in conjunction with the Alternate Methods provisions in Chapter 1, or for a review of submittals such as those in Section 909 or elsewhere requiring a rational analysis or performance-based design. These provisions to provide a recognized an established framework for the code official in terms of the design expertise needed, the necessary submittals, a review framework and related items. While not every step is required in every instance, these model provisions serve as the starting point for the formulation of an effective submittal and corresponding thorough review.~~

Commenter's Reason: This change was recommended for Approval as Submitted by the Admin Committee in Albuquerque. The proponents listened to the comments of the testifiers and the committee and agree that the original introduction paragraph was not exactly written in enforceable language. We now propose a modification to simply streamline the Introduction and make it enforceable, and the remaining points will be suggested for the Code Commentary. This modification does not change the scope, intent or application of the original change as was recommended for approval.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Streamlining the introduction paragraph has no effect on the cost impact of the original proposal.

Public Comment# 1794

ADM45-19

IBC@: APPENDIX O (New), O101.1, O102.1, O103.1 (New)

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

2018 International Building Code

Add new text as follows:

APPENDIX O APPROVAL OF PRODUCT EVALUATION AND LISTING AGENCIES

O101.1 Purpose. The purpose of this appendix is to provide the Building Official criteria to assist in the consideration and approval of products and systems supported by product listings and product evaluation reports. The Building Official is authorized to accept research reports and product listings as proof of compliance with the International Building Code under the authority in Section 104.11 and as defined in Section 1703.4.2.

The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction,

O102.1 Definitions. Approved Agency – See Section 202

Approved Listing Agency - Any agency approved by the Building Official which is in the business of listing and labeling and which makes available at least an annual published report of such listings in which specific information is included that the product has been tested to recognized standards and found to comply.

Approved Testing Agency - An agency which is determined by the Building Official to have adequate personnel and expertise to carry out the testing of systems, materials types of construction, fixtures or appliances.

Approved Source See Section 202

Label - See Section 202

Research report – A report published by an approved source to provide technical evaluation that a new or alternative material, product, design or method of construction complies with the intent of the International Building Code and includes supporting data, and where necessary, to assist in the approval of materials or assemblies not specifically provided for in the code.

O103.1 Qualifications. Listing Agencies issuing a product Listing, and Approved Sources issuing a Research Report, shall be accredited by an approved accreditation body as to competence and capability in compliance with Sections 1703.1.1 through 1703.1.3. Approved Product Listing or Approved Sources issuing product evaluation reports satisfy the following requirements:

1. Approved agencies shall be accredited by Accreditation by a body that is a signatory to the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) and is itself accredited to ISO/IEC Standard 17011, General Requirements for accreditation bodies accrediting conformity assessment bodies (CABs).
2. The agency shall employ qualified technical personal familiar with the *International Building Code* and the *International Fire Code* and their referenced standards as well as the evaluation criteria and standards used to produce the evaluation report.
3. Evaluation Reports shall be issued under the supervision of a licensed professional engineer.
4. The agencies shall implement a product labeling and identification program consistent with requirements for labeling in the code.
5. The agencies shall publish lists for evaluated or listed materials, assemblies or products.
6. The Agencies shall develop and implement quality control programs that shall be satisfied by the product evaluation and listing report holder and shall require follow up in-plant inspections to determine compliance with the approved quality control program.
7. The agencies shall publish Research Reports or listings based on, in order of importance, the code; or standards recognized in the codes, and when the product is an alternative material or system recognized under IBC Section 104.11, Acceptance Criteria that have been developed with public input and are acceptable to the Building Official.
8. The agencies shall have a process to periodically re-evaluate published product evaluation reports and product listing to address applicable changes in the applicable codes, acceptance criteria or referenced published standards used in the evaluation report.
9. The Agencies shall develop and implement quality control programs that shall be satisfied by the product evaluation and listing report holder and shall require regular follow up in-plant inspections to verify compliance with the approved quality control program.

Reason: This code change is necessary to address the significant increase in the number of testing agencies and engineering firms as well as

industry associations developing product certification programs. The proposed Appendix offers an option for the Building Official to adopt the rules and criteria necessary criteria to evaluate the qualifications of the listing or product evaluation agency seeking recognition and approval. The Appendix can be applied to the IBC and IRC so a separate code change is not being proposed for the IRC. All jurisdictions adopt a building code in addition to one or more of the other codes that are members of the ICC family of codes so jurisdictions adopting the IBC have the option to adopt the proposed Appendix .

The code change also seeks to lay the ground work the formation of a body to create acceptance criteria used by all agencies. If one is not created then ICC Evaluation Service or IAPMO's Uniform Evaluation Service will be the only agencies we know that develop and publish evaluation criteria. Uniform acceptance criteria prevent venue shopping and improve the integrity of the process so that outcomes of the evaluations are reasonably similar. When the legacy Uniform Building Code published UBC Standards in volume 3 such standards existed and were regularly referenced. Unfortunately this is no longer true in today's complete market place.

ICC created its subsidiaries ICC ES and IAS to service the needs of the Building Official and manufacturers to create an accreditation process for testing agencies and product evaluation agencies producing research reports amongst others. They also created a service that produces research reports on behalf of the Building Official. The outcome of these evaluations and listings need to be accepted by the Building Official to be implemented. The technical reviews are performed on behalf of the Building Official so as not to require each jurisdiction to develop their own internal process for accepting building products.

A healthy competitive market with firms producing product listings and research reports has resulted in the need to create rules that facilitate approval or disapproval of these agencies and to create uniformity in the industry.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change is mainly process related and does not impose new requirements. Most agencies function as proposed in the code change.

ADM45-19

Public Hearing Results

Errata: This proposal includes published errata
Item list 1-9 for the new proposed Section O103.1 Qualifications has been added.

Committee Action:

Disapproved

Committee Reason: The committee stated that the reason for the disapproval was that the new proposed section should be in the appropriate location in the body of the code instead of as an appendix and that it needs further work including the proper framework and information for building departments. (Vote: 13-0)

Assembly Action:

None

ADM45-19

Individual Consideration Agenda

Public Comment 1:

IBC@: O101.1, O102.1, O103.1 (New), O103.2 (New)

Proponents:

Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

O101.1 Purpose. The purpose of this appendix is to provide the Building Official criteria to assist in the consideration and approval of products and systems supported by product *listings* and *product evaluation* reports. The Building Official is authorized to accept product evaluation research reports and product listings as proof of compliance with the *International Building Code* and the *International Residential Code* under the authority in

Section 104.11 and as defined in Section 1703.4.2.

~~The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction:~~

O102.1 Definitions. Approved Agency – See Section 202

Approved Listing Agency - Any agency approved by the Building Official which is in the business of listing and labeling and which makes available at least an annual published report of such listings in which specific information is included that the product has been tested to recognized standards and found to comply.

Approved Testing Agency - An agency which is determined by the Building Official to have adequate personnel and expertise to carry out the testing of systems, materials types of construction, fixtures or appliances.

Approved Source See Section 202

Label - See Section 202

Research report – A report published by an approved source to provide technical evaluation that a new or alternative material, product, design or method of construction complies with the intent of the International Building Code and includes supporting data, and where necessary, to assist in the approval of materials or assemblies not specifically provided for in the code.

O103.1 Qualifications. Listing Agencies issuing a product ~~Listing listing~~, and ~~Approved Sources approved sources~~ issuing a product evaluation report ~~Research Report~~, shall be accredited by an approved accreditation body as to competence and capability in compliance with Sections 1703.1.1 through 1703.1.3. ~~Approved Product listing agencies or Approved Sources approved sources~~ issuing product evaluation reports shall satisfy the following requirements:

1. Approved agencies shall be accredited by an accreditation ~~Accreditation~~ by a body that is a signatory to the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) and is itself accredited to ISO/IEC Standard 17011, General Requirements for accreditation bodies accrediting conformity assessment bodies (CABs).
2. ~~The agency shall~~ Shall employ qualified technical personal familiar with the *International Building Code* and the *International Residential International Code* and the *International Fire Code* and their referenced standards as well as the evaluation criteria and standards used to produce the evaluation report.
3. Product evaluation reports ~~Evaluation Reports~~ for structural components shall be issued under the supervision of a licensed professional engineer.
4. ~~The agencies shall implement a product labeling and identification program consistent with requirements for labeling in the code.~~
5. ~~The agencies shall publish lists for evaluated or listed materials, assemblies or products.~~
6. ~~The Agencies shall develop and implement quality control programs that shall be satisfied by the product evaluation and listing report holder and shall require follow up in plant inspections to determine compliance with the approved quality control program.~~
7. ~~The agencies shall publish Research Reports or listings based on, in order of importance, the code; or standards recognized in the codes; and when the product is an alternative material or system recognized under IBC Section 104.11, Acceptance Criteria that have been developed with public input and are acceptable to the Building Official.~~
8. ~~The agencies shall have a process to periodically re-evaluate published product evaluation reports and product listing to address applicable changes in the applicable codes, acceptance criteria or referenced standards used in the evaluation report.~~
9. ~~The Agencies shall develop and implement quality control programs that shall be satisfied by the product evaluation and listing report holder and shall require regular follow up in plant inspections to verify compliance with the approved quality control program.~~

O103.2 Review and Listing Process Listing agencies and approved sources issuing a product evaluation report shall perform their duties in accordance with the limitations of their accreditation as well as the following requirements:

1. The agencies shall implement a product labeling and identification program consistent with requirements for labeling in the code.
2. The agencies shall publish lists for evaluated or listed materials, assemblies or products.
3. The agencies shall develop and implement quality control programs that shall be satisfied by the product evaluation report and listing report holder and shall require regular follow up in-plant inspections to determine compliance with the approved quality control program.
4. The agencies shall publish product evaluation reports or listings based on, in order of importance, the code; or standards recognized in the codes.
5. When the product is an alternative material or system recognized in the Code under Section 104.11 of the International Building Code, acceptance criteria that have been developed with public input and that are acceptable to the Building Official shall be the basis of the review.
6. The agencies shall have a process to periodically re-evaluate published product evaluation reports and product listing to address applicable changes in the applicable codes, acceptance criteria or referenced standards used in the evaluation report.

Commenter's Reason: The public comment for ADM 45-19 was developed in collaboration the joint effort of several listing agencies, agencies that

issue product evaluation reports (also referred to as code compliance reports, research reports, etc), manufacturers and other interested parties. Input was also solicited from interested parties that spoke in support and in opposition to the code change at the Committee Action Hearings in Albuquerque. A working group was formed and met one time. During our meeting it was apparent that three groups exist: one group that believes that rules need to be developed due to the view that "wild west" has developed where anyone can claim to produce a product evaluation report or listing.

During the CAH some speakers stated that ICC should form an ad-hoc group to evaluate the issues beings addressed in the change to include all providers or product evaluation reports and listings. The Compliance Code Action Committee is such a group however the group was not very well publicized and had limited participation as was stated in the CAH and has proposed ADM 23-19.

The ad-hoc group that participated included representation from:

1. Underwriters Laboratories
2. Intertek
3. Uniform Evaluation Service
4. DRJ Engineering
5. City of Los Angeles
6. Hilti
7. Simpson Strong Tie
8. Code Consultants, Thomas Meyers
9. Intech Consulting, Lorraine Ross
10. Preview Group, Steve Winkle.
11. ICC ES was contacted and provided input but did not participate directly.
12. APA was contacted
13. International Code Consultants, Jeff Shapiro was contacted
14. Michael Savage, Compliance Code Action Committee was contacted

During the working group meeting it became clear that there were 4 major encampments on the issue:

1. The do nothing maintain status quo group.
2. The something needs to be done group, but it should be the ICC Board's role and not a code change issue.
3. There is a need to get some consistency and for competition in the market place to be based on the use of uniform evaluation criteria and customer service. In other words cost, speed of service, technical soundness of the review and not the review outcome.
4. Supporters of ADM 45-19 that see it as a middle road that accommodates current practices and raises the bar but does not raise it too high to not be achievable.

The public comment addresses the issues raised by the General committee and the speakers in opposition to the code change.

The appendix is offered as a stand alone option that relies on portions of the chapter 2 definitions to avoid repetition.

The definition of approved source is expanded to directly address accredited product certification agencies to allow test labs or licensed engineers to produce product evaluation reports for specific items.

A listing is defined. It may appear obvious to most code users what it is but a listing really is something in a list but in the context of the code it is proof of compliance with a referenced standard in the code such as a fire resistance rating tested to an ASTM or UL standard.

Research report is changed to a more generic term product evaluation report to reflect the propriety and not a prescriptive nature of the building material.

Product evaluation reports for structural components require supervision by a licensed engineer. The engineer only needs to be licensed by the State in which he/she practices and is reflective of current practice where an ICC ES staff engineer develops acceptance criteria and publishes evaluation reports in Birmingham for use throughout the United States. Licensure is proof of proficiency in the use of codes and standards by a State and thus higher than obtaining a degree by education. This addresses concerns raised by some speakers in opposition or who submitted floor modifications.

The qualifications sections have been split into two sections one for qualifications and one to describe the process envision in IBC Ch. 17.

The word accreditation is used repeatedly to make clear that testing and product certification agencies are accredited as proof of proficiency as and process in compliance with the ISO/IEC standard 17011. The International Accreditation Service (IAS), an ICC subsidiary, as well as ANSI evaluate the competencies of product certification bodies and testing agencies and issue certificates of accreditation to competencies to test or evaluate to specific standards listed in the accreditation. The term was chosen to coincide with the terminology that the industry utilizes.

Clarification has been added that product evaluations demonstrating equivalence to the code should be based on acceptance criteria developed in similar fashion to the prescribed standards in the code. It is important that evaluation criteria used in the product evaluation be developed in as open and transparent process as possible and the proposed code change maintains that requirement. This is generally reflective of current practice for some providers of product evaluation reports who may or may not produce product evaluation reports. As stated in the original code change reason statement it is hoped at some point that criteria development and its costs be separated from publication of product evaluation reports and that product evaluations demonstrate proficiency in the evaluation criteria and the code.

An effort has been made to differentiate a product listing from a product evaluation and to make clear what approved means. A product listing is proof of compliance with a standard actually referenced in the code like fire doors, penetration fire stop assemblies etc. A product evaluation report evaluates a product to be equivalent to that which is prescribed in the code. A steel joist hanger for example or strap is not prescribed in the code and therefore a product evaluation report determines its load carrying capacity based on testing or engineer or both and prescribes conditions of use interior/exterior, the method of fastening, the substrate, etc. Only the Building Official approves the use of the product by approving it on building construction plans.

ADM 45-19 does not conflict with ADM 23-19 and is designed as stand-alone and is non-mandatory in an Appendix to the IBC. As such jurisdictions such as City of Los Angeles, the California State fire Marshal, Miami/Dade, New York City and many others can continue their current practice. Additionally, feedback received has shows that the proposed code change generally reflects current practice.

The proponent has served the ICC membership as chair of the ICC ES Evaluation Committee and as a member for 6 years. Supporters either retired or current Building Officials include past members of the ICC or ICBO ES committees as well. This is not an ICC ES code change and is intended to be as neutral as possible and to look out for the interest of the public and Building Officials.

This code change requires 2/3 of the governmental voting members to support it for the final action to pass. Please support the direction of the Administrative Committee that saw merit in the code change but wanted changes made to reflect the issues raised at the CAH. Please vote for approved as modified by public comment 2.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal implements current practice. New agencies or approved source will incur additional costs reflected in the cost of service provided to the manufacturer or applicant.

Public Comment# 1332

ADM47-19

This is the referenced standards administrative update code change intended to be heard as a single code change. This code change was set up to include all of the ICC codes in an effort to allow for easier review by code users. ADM47-19 will be heard at the PCH as a single code change. ADM47-19 received 19 public comments that procedurally will be dealt with as separate parts in conjunction with the public comment submitted. Also refer to the Discussion Guide for further information related to the CAH results and the public comments related to each standard that received a public comment.

ADM47-IBC-19

Proposed Change as Submitted

AA	Aluminum Association	
Standard Reference Number	Title	Referenced in Code(s):
ADM1—2015 <u>ADM1—2020</u>	Aluminum Design Manual: Part 4— A Specification <u>1—Specification</u> for Aluminum Structures	IBC®
AAMA	American Architectural Manufacturers Association	
Standard Reference Number	Title	Referenced in Code(s):
711—16 <u>711—20</u>	Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products	IBC®
714—15 <u>714—20</u>	Voluntary Specification for Liquid Applied Flashing Used to Create a Water-resistive Seal around Exterior Wall Openings in Buildings	IBC®
ACI	American Concrete Institute	
Standard Reference Number	Title	Referenced in Code(s):
318—14 <u>318—19</u>	Building Code Requirements for Structural Concrete	IBC®
AISI	American Iron and Steel Institute	
Standard Reference Number	Title	Referenced in Code(s):
AISI S100—16 <u>S1—18</u>	North American Specification for the Design of Cold-formed Steel Structural Members, 2016, <u>with Supplement 1, dated 2018</u>	IBC®
AISI S202—15 <u>S202—20</u>	Code of Standard Practice for Cold-formed Steel Structural Framing, 2015 <u>2020</u>	IBC®
AISI S220—15 <u>S220—20</u>	North American Standard for Cold-formed Steel Framing—Nonstructural Members, 2015 <u>2020</u>	IBC®
AISI S230—15 <u>S230—18</u>	Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, 2015 <u>2018</u>	IBC®
AISI S240—15 <u>S240—20</u>	North American Standard for Cold-Formed Steel Structuring Framing, 2015 <u>2020</u>	IBC®
AISI S400—15 <u>S1—16</u> S400—20	North American Standard for Seismic Design of Cold-formed Steel Structural Systems, 2015, with Supplement 1, dated 2016 <u>2020</u>	IBC®
ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):

A13.1—2015 <u>A13.1—2020</u>	Scheme for the Identification of Piping Systems	IBC®
A108.1A—16 <u>A108.1A—17</u>	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar	IBC®
A108.1B—99 <u>A108.1B—17</u>	Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Mortar	IBC®
A108.4—99 <u>A108.4—09</u>	Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive	IBC®
A108.5—99 <u>A108.5—19</u>	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-Portland Cement Mortar	IBC®
A108.6—99 <u>A108.6—19</u>	Installation of Ceramic Tile with Chemical-resistant, Water Cleanable Tile-setting and -grouting Epoxy	IBC®
A108.8—99 <u>A108.8—19</u>	Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout	IBC®
A108.9—99 <u>A108.9—19</u>	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout	IBC®
A108.10—99 <u>A108.10—17</u>	Installation of Grout in Tilework	IBC®
A118.1—16 <u>A118.1—18</u>	American National Standard Specifications for Dry-set Portland Cement Mortar	IBC®
A118.3—13 <u>A118.3—20</u>	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive	IBC®
A118.4—16 <u>A118.4—18</u>	American National Standard Specifications for Modified Dry-set Cement Mortar	IBC®
A118.6—10 <u>A118.6—19</u>	American National Standard Specifications for Cement Grouts for Tile Installation	IBC®
A136.1—08 <u>A136.1—19</u>	American National Standard Specifications for the Installation of Ceramic Tile	IBC®
A137.1—17 <u>A137.1—19</u>	American National Standard Specifications for Ceramic Tile	IBC®
APA	APA - Engineered Wood Association	
Standard Reference Number	Title	Referenced in Code(s):
ANSI 447—15 <u>117—2020</u>	Standard Specification for Structural Glued Laminated Timber of Softwood Species	IBC®
ANSI/APA A190.1—17 <u>A190.1—2017</u>	Structural Glued Laminated Timber	IBC®
ANSI/APA PRP 240—14 <u>210—2019</u>	Standard for Performance-Rated Engineered Wood Siding	IBC®
APA PDS—12 <u>PDS—20</u>	Panel Design Specification	IBC®
ANSI/APA PRG 320—17 <u>320—2019</u>	Standard for Performance-rated Cross-laminated Timber	IBC®
APA R540—13 <u>R540—19</u>	Builders Builder Tips: Proper Storage and Handling of Glulam Beams	IBC®
APA S475—16 <u>S475—20</u>	Glued Laminated Beam Design Tables	IBC®
APA S560—14 <u>S560—20</u>	Field Notching and Drilling of Glued Laminated Timber Beams	IBC®
APA X450—04 <u>X450—18</u>	Glulam in Residential Construction— Western Edition Building—Construction Guide	IBC®
ASABE	American Society of Agricultural and Biological Engineers	

Standard Reference Number	Title	Referenced in Code(s):
EP 484.3 MON2016 DEC2017	Diaphragm Design of Metal-clad, Wood-frame Rectangular Buildings	IBC®
EP 486.2 OCT 2012ED486.3 SEP2017	Shallow-post and Pier Foundation Design	IBC®
EP 559.2 MON2016559.1 W/Corr. AUG2010 (R2014)	Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies	IBC®
ASCE/SEI	American Society of Civil EngineersStructural Engineering Institute	
Standard Reference Number	Title	Referenced in Code(s):
7—16 with Supplement 1	Minimum Design Loads and Associated Criteria for Buildings and Other Structures	IBC®
24—14 24—20	Flood Resistant Design and Construction	IBC®
29—17 29—19	Standard Calculation Methods for Structural Fire Protection	IBC®
49—07 49—12	Wind Tunnel Testing for Buildings and Other Structures	IBC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ASME/A17.1—2016A17.1—2019/CSA B44—16B44—19	Safety Code for Elevators and Escalators	IBC®
A17.7—2007/CSA B44—07(R2012)B44—07(R2019)	Performance-based Safety Code for Elevators and Escalators	IBC®
A18.1—2014A18.1—2020	Safety Standard for Platform Lifts and Stairway Chairlifts	IBC®
A90.1—2015A90.1—2020	Safety Standard for Belt Manlifts	IBC®
B16.18—2012 B16.18—2018	Cast Copper Alloy Solder Joint Pressure Fittings	IBC®
B16.22—2013 B16.22—2018	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	IBC®
B20.1—2015 B20.1—2021	Safety Standard for Conveyors and Related Equipment	IBC®
B31.3—2016 B31.3—2020	Process Piping	IBC®
ASSE	American Society of Safety Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ASSE Z359.1—2016ASSP Z359.1—2019	Requirements for the ANSI/ASSE Z359 The Fall Protection Code	IBC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A6/A6M—14A6M—2017A	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling	IBC®
A153/A153M—09A153M—2016A	Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware	IBC®
A240/A240M—15aA240M—17	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications	IBC®

A252—10A252—2010(2018)	Specification for Welded and Seamless Steel Pipe Piles	IBC®
A283/A283M—13A283M—2018	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	IBC®
A416/A416M—15A416M—2017A	Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete	IBC®
A572/A572M—15A572M—2018	Specification for High-strength Low-alloy Columbium-Vanadium Structural Steel	IBC®
A653/A653M—15A653M—2017	Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process	IBC®
A690/A690M—13aA690M—13a(2018)	Standard Specification for High-strength Low-alloy Nickel, Copper, Phosphorus Steel H-piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments	IBC®
A706/A706M—15A706M—2016	Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement	IBC®
A722/A722M—15A722M—2018	Specification for High-strength Steel Bars for Prestressed Concrete	IBC®
A755/A755M—15A755M—2016E1	Specification for Steel Sheet, Metallic-coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products	IBC®
A924/A924M—14A924M—2017A	Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process	IBC®
B88—14B88—2016	Specification for Seamless Copper Water Tube	IBC®
B251—10B251/B251M—2017	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	IBC®
B280—13B280—2018	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	IBC®
B695—04(2009)B695—2004(2016)	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel Strip for Building Construction	IBC®
C5—10C5—2018	Specification for Quicklime for Structural Purposes	IBC®
C27—98(2013)C27—1998(2018)	Specification for Classification of Fireclay and High-alumina Refractory Brick	IBC®
C31/C31M—15C31M—2018B	Practice for Making and Curing Concrete Test Specimens in the Field	IBC®
C33/C33M—13C33M—2018	Specification for Concrete Aggregates	IBC®
C55—2014aC55—2017	Specification for Concrete Building Brick	IBC®
C62—13aC62—2017	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)	IBC®
C67—14C67/C67M—2018	Test Methods of Sampling and Testing Brick and Structural Clay Tile	IBC®
C73—14C73—2017	Specification for Calcium Silicate Brick (Sand-lime Brick)	IBC®
C90—14C90—2016A	Specification for Loadbearing Concrete Masonry Units	IBC®
C91/C91M—12C91M—2018	Specification for Masonry Cement	IBC®
C94/C94M—15aC94M—2017A	Specification for Ready-mixed Concrete	IBC®
C140/C140M—15C140M—2018	Test Method Sampling and Testing Concrete Masonry Units and Related Units	IBC®
C150/C150M—15C150M—2018	Specification for Portland Cement	IBC®

C172/C172M—14aC172M—2017	Practice for Sampling Freshly Mixed Concrete	IBC®
C199—84(2011)C199—1984(2016)	Test Method for Pier Test for Refractory Mortars	IBC®
C208—12C208—2012(2017)E1	Specification for Cellulosic Fiber Insulating Board	IBC®
C216—15C216—2017A	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)	IBC®
C315—07(2011)C315—2007(2016)	Specification for Clay Flue Liners and Chimney Pots	IBC®
C317/C317M—00(2015)C317M—2000(2015)	Specification for Gypsum Concrete	IBC®
C330/C330M—14C330M—2017A	Specification for Lightweight Aggregates for Structural Concrete	IBC®
C331/C331M—14C331M—2017	Specification for Lightweight Aggregates for Concrete Masonry Units	IBC®
C473—15C473—2017	Test Methods for Physical Testing of Gypsum Panel Products	IBC®
C475/C475M—15C475M—2017	Specification for Joint Compound and Joint Tape for Finishing Gypsum Board	IBC®
C516—08(2014)e1C516—2008(2013)E1	Specifications for Vermiculite Loose Fill Thermal Insulation	IBC®
C547—15C547—2017	Specification for Mineral Fiber Pipe Insulation	IBC®
C549—06(2012)	Specification for Perlite Loose Fill Insulation	IBC®
C552—15C552—2017E1	Standard Specification for Cellular Glass Thermal Insulation	IBC®
C557—03(2009)e01C557—2003(2017)	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing	IBC®
C578—15C578—2018	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation	IBC®
C587—04(2014)C587—2004(2018)	Specification for Gypsum Veneer Plaster	IBC®
C595/C595M—14e1C595M—2018	Specification for Blended Hydraulic Cements	IBC®
C635/C635M—13aC635M—2017	Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings	IBC®
C652—15C652—2017A	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)	IBC®
C726—12C726—2017	Standard Specification for Mineral Wool Roof Insulation Board	IBC®
C728—15C728—2017A	Standard Specification for Perlite Thermal Insulation Board	IBC®
C744—14C744—2016	Specification for Prefaced Concrete and Calcium Silicate Masonry Units	IBC®
C754—15C754—2018	Specification for Installation of Steel Framing Members to Receive Screw-attached Gypsum Panel Products	IBC®
C836/C836M—15C836M—2018	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course	IBC®
C840—13C840—2018A	Specification for Application and Finishing of Gypsum Board	IBC®

C841—03(2013)C841—2003(2018)	Specification for Installation of Interior Lathing and Furring	IBC®
C843—99(2012)C843—2017	Specification for Application of Gypsum Veneer Plaster	IBC®
C847—14aC847—2018	Specification for Metal Lath	IBC®
C920—14aC920—2018	Standard for Specification for Elastomeric Joint Sealants	IBC®
C926—15bC926—2018B	Specification for Application of Portland Cement-based Plaster	IBC®
C933—14C933—2018	Specification for Welded Wire Lath	IBC®
C946—10C946—2018	Specification for Construction of Dry-stacked, Surface-bonded Walls	IBC®
C954—15C954—2018	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch (0.84 mm) to 0.112 inch (2.84 mm) in Thickness	IBC®
C957/C957M—15C957M—2017	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane with Integral Wearing Surface	IBC®
C1002—14C1002—2018	Specification for Steel Self-piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs	IBC®
C1032—14C1032—2018	Specification for Woven Wire Plaster Base	IBC®
C1047—14aC1047—2018	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base	IBC®
C1063—15aC1063—2018B	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-based Plaster	IBC®
C1088—14C1088—2018	Specification for Thin Veneer Brick Units Made from Clay or Shale	IBC®
C1157/C1157M—11C1157M—2017	Standard Performance Specification for Hydraulic Cement	IBC®
C1167—11C1167—2011(2017)	Specification for Clay Roof Tiles	IBC®
C1177/C1177M—13C1177M—2017	Specification for Glass Mat Gypsum Substrate for Use as Sheathing	IBC®
C1178/C1178M—13C1178M—2018	Specification for Coated Mat Water-resistant Gypsum Backing Panel	IBC®
C1186—08(2012)C1186—2008(2016)	Specification for Flat Fiber Cement Sheets	IBC®
C1261—13C1261—2013(2017)E1	Specification for Firebox Brick for Residential Fireplaces	IBC®
C1278/C1278M—07a(2011)C1278M—2017	Specification for Fiber-reinforced Gypsum Panel	IBC®
C1283—11C1283—2015	Practice for Installing Clay Flue Lining	IBC®
C1288—14C1288—2017	Standard Specification for Discrete Nonasbestos Fiber-cement Interior Substrate Sheets	IBC®
C1289—15C1289—2018	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	IBC®
C1325—14C1325—2018	Standard Specification for Nonasbestos Fiber-mat Reinforced Cement Backer Units	IBC®
C1364—10BC1364—2017	Standard Specification for Architectural Cast Stone	IBC®
C1396/C1396M—14aC1396M—2017	Specification for Gypsum Board	IBC®

C1492—03(2009) C1492—2003(2016)	Standard Specification for Concrete Roof Tile	IBC®
C1600/C1600M—11C1600M—2017	Standard Specification for Rapid Hardening Hydraulic Cement	IBC®
C1629/C1629M—15C1629M—2018A	Standard Classification for Abuse-resistant Nondecorated Interior Gypsum Panel Products and Fiber-reinforced Cement Panels	IBC®
C1658/C1658M—13C1658M—2018	Standard Specification for Glass Mat Gypsum Panels	IBC®
C1670—16C1670/C1670M—2018	Standard Specification for Adhered Manufactured Stone Masonry Veneer Units	IBC®
C1766—13C1766—2015	Standard Specification for Factory-laminated Gypsum Panel Products	IBC®
D25—12D25—2012(2017)	Specification for Round Timber Piles	IBC®
D41/D41M—11D41M—2011(2016)	Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing	IBC®
D43/D43M—00(2012)e+D43M—2000(2018)	Specification for Coal Tar Primer Used in Roofing, Dampproofing and Waterproofing	IBC®
D56—05(2010) D56—2016A	Test Method for Flash Point by Tag Closed Cup Tester	IBC®
D86—15D86—2017	Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure	IBC®
D93—15D93—2018	Test Methods for Flash Point by Pensky-Martens Closed Cup Tester	IBC®
D226/D226M—09D226M—2017	Specification for Asphalt-saturated Organic Felt Used in Roofing and Waterproofing	IBC®
D227/D227M—03(2011)e+D227M—2003(2018)	Specification for Coal-tar-saturated Organic Felt Used in Roofing and Waterproofing	IBC®
D312/D312M—15D312M—2016M	Specification for Asphalt Used in Roofing	IBC®
D448—2012D448—2012(2017)	Standard Classification for Sizes of Aggregate for Road and Bridge Construction	IBC®
D450/D450M—07(2013)e+D450M—2017(2018)	Specification for Coal-tar Pitch Used in Roofing, Dampproofing and Waterproofing	IBC®
D1143/D1143M—07(2013)D1143M—2007(2013)E1	Test Methods for Deep Foundations Under Static Axial Compressive Load	IBC®
D1863/D1863M—05(2011)e+D1863M—2005(2018)	Specification for Mineral Aggregate Used on Built-up Roofs	IBC®
D1970/D1970M—15aD1970M—2017A	Specification for Self-adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roof Underlayment for Ice Dam Protection	IBC®
D2178/D2178M—15D2178M—15A	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	IBC®
D2487—11D2487—2017	Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	IBC®
D2822/D2822M—05(2011)e+D2822M—2005(2011)	Specification for Asphalt Roof Cement, Asbestos Containing	IBC®

D2824/D2824M—13D2824M—2018	Standard Specification for Aluminum-pigmented Asphalt Roof Coatings, Nonfibered and Fibered without Asbestos	IBC®
D2859—16D2859—2016	Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials	IBC®
D2898—10D2898—2010(2017)	Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing	IBC®
D3019—08D3019/D3019M—2017	Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered and Nonasbestos Fibered	IBC®
D3161/D3161M—15D3161M—2016A	Test Method for Wind Resistance of Steep Slope Roofing Products (Fan Induced Method)	IBC®
D3200—74(2012)D3200—1974(2017)	Standard Specification and Test Method for Establishing Recommended Design Stresses for Round Timber Construction Poles	IBC®
D3462/D3462M—40aD3462M—2016	Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules	IBC®
D3679—13D3679—2017	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding	IBC®
D3737—12D3737—2018E1	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)	IBC®
D3746—85(2008)D3746/D3746M—1985(2015)E1	Test Method for Impact Resistance of Bituminous Roofing Systems	IBC®
D3957—09D3957—2009(2015)	Standard Practices for Establishing Stress Grades for Structural Members Used in Log Buildings	IBC®
D4318—10e4D4318—2017E1	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils	IBC®
D4434/D4434M—12D4434M—2015	Specification for Poly (Vinyl Chloride) Sheet Roofing	IBC®
D4479/D4479M—07(2012)e4D4479M—2007(2018)	Specification for Asphalt Roof Coatings—Asbestos-free	IBC®
D4586/D4586M—07(2012)e4D4586M—2007(2018)	Specification for Asphalt Roof Cement—Asbestos-free	IBC®
D4637/D4637M—44e4D4637M—2015	Specification for EPDM Sheet Used in Single-ply Roof Membrane	IBC®
D4869/D4869M—15D4869M—2016A	Specification for Asphalt-saturated (Organic Felt) Underlayment Used in Steep Slope Roofing	IBC®
D4897/D4897M—01(2009)D4897M—2016	Specification for Asphalt-coated Glass Fiber Venting Base Sheet Used in Roofing	IBC®
D4945—12D4945—2017	Test Method for High-strain Dynamic Testing of Deep Foundations	IBC®
D5055—13e4D5055—2016	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists	IBC®
D5456—14bD5456—2018	Specification for Evaluation of Structural Composite Lumber Products	IBC®
D5516—09D5516—2018	Test Method of Evaluating the Flexural Properties of Fire-retardant Treated Softwood Plywood Exposed to Elevated Temperatures	IBC®
D5643/D5643M—06(2012)e4D5643M—2006(2018)	Specification for Coal Tar Roof Cement, Asbestos-free	IBC®

D5664 —10 <u>D5664</u> —2017	Standard Test Method for Evaluating the Effects of Fire-retardant Treatment and Elevated Temperatures on Strength Properties of Fire-retardant Treated Lumber	IBC®
D6083 — 05e04 <u>D6083/D6083M</u> —2018	Specification for Liquid Applied Acrylic Coating Used in Roofing	IBC®
D6162/D6162M — 00a(2015)e4 <u>D6162M</u> —2016	Specification for Styrene-butadiene-styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	IBC®
D6163/D6163M — 00(2015)e4 <u>D6163M</u> —2016	Specification for Styrene-butadiene-styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements	IBC®
D6164/D6164M —11 <u>D6164M</u> — <u>2016</u>	Specification for Styrene-butadiene-styrene (SBS) Modified Bituminous Sheet Metal Materials Using Polyester Reinforcements	IBC®
D6222/D6222M —14 <u>D6222M</u> — <u>2016</u>	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements	IBC®
D6223/D6223M — 02(2009)e4 <u>D6223M</u> —2016	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	IBC®
D6298 —13 <u>D6298/D6298M</u> — <u>2016</u>	Specification for Fiberglass Reinforced Styrene-butadiene-styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface	IBC®
D6380/D6380M — 03(2013)e4 <u>D6380M</u> — <u>2003(2018)</u>	Standard Specification for Asphalt Roll Roofing (Organic) Felt	IBC®
D6464 —03a(2009)e4 <u>D6464</u> — <u>2003A(2017)</u>	Standard Specification for Expandable Foam Adhesives for Fastening Gypsum Wallboard to Wood Framing	IBC®
D6509/D6509M — 09(2015) <u>D6509M</u> —2016	Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements	IBC®
D6754/D6754M —10 <u>D6754M</u> — <u>2015</u>	Standard Specification for Ketone Ethylene Ester Based Sheet Roofing	IBC®
D6757 —2013 <u>D6757/D6757M</u> — <u>2018</u>	Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep Slope Roofing	IBC®
D6841 —08 <u>D6841</u> —2016	Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-retardant Treated Lumber	IBC®
D6878/D6878M —13 <u>D6878M</u> — <u>2017</u>	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing	IBC®
D6947/D6947M — 07(2013)e4 <u>D6947M</u> —2016	Standard Specification for Liquid Applied Moisture Cured Polyurethane Coating Used in Spray Polyurethane Foam Roofing System	IBC®
D7032 —14 <u>D7032</u> —2017	Standard Specification for Establishing Performance Ratings for Wood, Plastic Composite Deck Boards and Guardrail Systems (Guards or Rails)	IBC®
D7147 —14 <u>D7147</u> —2011(2018)	Specification for Testing and Establishing Allowable Loads of Joist Hangers	IBC®

D7158/D7158M—16D7158M—2019	Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)	IBC®
D7254—15D7254—2017	Standard Specification for Polypropylene (PP) Siding	IBC®
D7655/D7655M—12D7655M—2012(2017)	Standard Classification for Size of Aggregate Used as Ballast for Roof Membrane Systems	IBC®
D7672—14D7672—14E1	Standard Specification for Evaluating Structural Capacities of Rim Board Products and Assemblies	IBC®
E84—16E84—2018B	Standard Test Methods for Surface Burning Characteristics of Building Materials	IBC®
E90—09E90—2009(2016)	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	IBC®
E96/E96M—15E96M—2016	Standard Test Methods for Water Vapor Transmission of Materials	IBC®
E108—16E108—2017	Standard Test Methods for Fire Tests of Roof Coverings	IBC®
E119—16E119—2018B	Standard Test Methods for Fire Tests of Building Construction and Materials	IBC®
E136—16E136—2016A	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	IBC®
E283—04(2012)E283—2004(2012)	Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences across the Specimen	IBC®
E331—00(2009)E331—2000(2016)	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference	IBC®
E492—09E492—2009(2016)E1	Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-ceiling Assemblies Using the Tapping Machine	IBC®
E648—15e1E648—2017A	Standard Test Method for Critical Radiant Flux of Floor-covering Systems Using a Radiant Heat Energy Source	IBC®
E736/E736M—00(2015)e1E736M—2017	Test Method for Cohesion/Adhesion of Sprayed Fire-resistive Materials Applied to Structural Members	IBC®
E814—2013AE814—2013A(2017)	Test Method for Fire Tests of Penetration Firestop Systems	IBC®
E970—14E970—2017	Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source	IBC®
E1300—12ae1E1300—2016	Practice for Determining Load Resistance of Glass in Buildings	IBC®
E1354—16E1354—17	Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter	IBC®
E1592—05(2012)E1592—2005(2017)	Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference	IBC®
E1602—03(2010)e1E1602—2003(2017)	Guide for Construction of Solid Fuel-burning Masonry Heaters	IBC®

E1886—13A <u>E1886—2013A</u>	Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials	IBC®
E1996—14a <u>E1996—2017</u>	Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes	IBC®
E2174—14b <u>E2174—2018</u>	Standard Practice for On-site Inspection of Installed Fire Stops	IBC®
E2273—03(2011) <u>E2273—2018</u>	Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies	IBC®
E2307—15b <u>E2307—15BE1</u>	Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using the Intermediate-scale, Multistory Test Apparatus	IBC®
E2353—14E <u>2353—2016</u>	Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards and Balustrades	IBC®
E2404—15a <u>E2404—2017</u>	Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facing and Veneers to Assess Surface Burning Characteristics	IBC®
E2556/E2556M—10E <u>2556M—2010(2016)</u>	Standard Specification for Vapor Permeable Flexible Sheet Water-resistive Barriers Intended for Mechanical Attachment	IBC®
E2568—09e1 <u>E2568—2017A</u>	Standard Specification for PB Exterior Insulation and Finish Systems	IBC®
E2570/E2570M—07(2014) <u>e1</u>	Standard Test Method for Evaluating Water-resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) for EIFS with Drainage	IBC®
E2573—12E <u>2573—2017</u>	Standard Practice for Specimen Preparation and Mounting of Site-fabricated Stretch Systems to Assess Surface Burning Characteristics	IBC®
E2579—13E <u>2579—2015</u>	Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics	IBC®
E2599—15E <u>2599—2018</u>	Standard Practice for Specimen Preparation and Mounting of Reflective Insulation, Radiant Barrier and Vinyl Stretch Ceiling Materials for Building Applications to Assess Surface Burning Characteristics	IBC®
E2634—11(2015) <u>E2634—2018</u>	Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems	IBC®
E2751/E2751M—13E <u>2751M—2017A</u>	Practice for Design and Performance of Supported Laminated Glass Walkways	IBC®
F547—06(2012) <u>F547—2017</u>	Terminology of Nails for Use with Wood and Wood-base Materials	IBC®
F1667—15F <u>1667—2018</u>	Specification for Driven Fasteners: Nails, Spikes and Staples	IBC®
F2200—14F <u>2200—2017</u>	Standard Specification for Automated Vehicular Gate Construction	IBC®
G154—12a <u>G154—2016A</u>	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	IBC®

AWC	American Wood Council	
Standard Reference Number	Title	Referenced in Code(s):
AWC STJR—2015 STJR—2021	Span Tables for Joists and Rafters	IBC®
ANSI/AWC PWF—2015 PWF—2021	Permanent Wood Foundation Design Specification	IBC®
ANSI/AWC SDPWS—2015 SDPWS—2021	Special Design Provisions for Wind and Seismic	IBC®
AWPA	American Wood Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
M4—16 M4—15	Standard for the Care of Preservative-treated Wood Products	IBC®
U1—16 U1—20	USE CATEGORY SYSTEM: User Specification for Treated Wood Except Commodity Specification H	IBC®
AWS	American Welding Society	
Standard Reference Number	Title	Referenced in Code(s):
D1.4/D1.4M—2017 D1.4M—2018	Structural Welding Code—Reinforcing Steel Including Metal Inserts and Connections In Reinforced Concrete Construction Code—Steel Reinforcing Bars	IBC®
BHMA	Builders Hardware Manufacturers' Association	
Standard Reference Number	Title	Referenced in Code(s):
A 156.10—2011 156.10—2017	Power Operated Pedestrian Doors	IBC®
A 156.19—2013 156.19—2020	Standard for Power Assist and Low Energy Power Operated Doors	IBC®
A 156.27—2011 156.27—2019	Power and Manual Operated Revolving Pedestrian Doors	IBC®
A 156.38—2014 156.38—2020	Low Energy Power Operated Sliding and Folding Doors	IBC®
CSA	Canadian Standards Association	
Standard Reference Number	Title	Referenced in Code(s):
ASME A17.1—2016 A17.1—2019/ CSA B44—16 B44—19	Safety Code for Elevators and Escalators	IBC®
ASME A17.7—2007 /CSA B44.7—07B44.7—07(R2017)	Performance-based Safety Code for Elevators and Escalators	IBC®
DASMA	Door & Access Systems Manufacturers Association International	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/DASMA 445—2016 115—2017	Standard Method for Testing Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure	IBC®
DOC	U.S. Department of Commerce	
Standard Reference Number	Title	Referenced in Code(s):
PS 1—091—19	Structural Plywood	IBC®
PS 2—102—18	Performance Standard for Wood-based Structural-use <u>Wood Structural</u> Panels	IBC®

PS 20—05	American Softwood Lumber Standard	IBC®
FM	FM Approvals	
Standard Reference Number	Title	Referenced in Code(s):
4880 — 2015 <u>4880</u> — 2017	Approval American National Standard for Class 4 Fire Rating of Building Panels or Evaluating the Fire Performance Insulated Building Panel Assemblies and Interior Finish Materials	IBC®
GA	Gypsum Association	
Standard Reference Number	Title	Referenced in Code(s):
GA 246 — 2016 <u>216</u> — 2018	Application and Finishing of Gypsum Panel Products	IBC®
GA 600 — 2015 <u>600</u> — 2018	Fire-resistance and Sound Control Design Manual, 21st 22nd Edition	IBC®
NAAMM	National Association of Architectural Metal Manufacturers	
Standard Reference Number	Title	Referenced in Code(s):
FP 4004 — 17 <u>1001</u> — 18	Guide Specifications for Design of Metal Flag Poles	IBC®
NCMA	National Concrete Masonry Association	
Standard Reference Number	Title	Referenced in Code(s):
TEK 5 — 84(1996) <u>5</u> — 84(2005)	Details for Concrete Masonry Fire Walls	IBC®
NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
40 — 18 <u>10</u> — 21	Standard for Portable Fire Extinguishers	IBC®
11 — 16	Standard for Low Low-, Medium, and High Expansion Foam	IBC®
12A — 15 <u>12A</u> — 18	Standard on Halon 1301 Fire Extinguishing Systems	IBC®
13 — 16 <u>13</u> — 19	Standard for Installation of Sprinkler Systems	IBC®
13D — 16 <u>13D</u> — 19	Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes	IBC®
13R — 16 <u>13R</u> — 19	Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies	IBC®
14 — 16 <u>14</u> — 19	Standard for the Installation of Standpipe and Hose System	IBC®
16 — 15 <u>16</u> — 19	Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems	IBC®
17 — 17 <u>17</u> — 20	Standard for Dry Chemical Extinguishing Systems	IBC®
17A — 17 <u>17A</u> — 20	Standard for Wet Chemical Extinguishing Systems	IBC®
20 — 16 <u>20</u> — 19	Standard for the Installation of Stationary Pumps for Fire Protection	IBC®
30 — 18 <u>30</u> — 21	Flammable and Combustible Liquids Code	IBC®
30A — 18 <u>30A</u> — 21	Code for Motor Fuel Dispensing Facilities and Repair Garages	IBC®
31 — 16 <u>31</u> — 20	Standard for the Installation of Oil-burning Equipment	IBC®
32 — 16	Standard for Dry Cleaning Plants <u>Drycleaning Facilities</u>	IBC®
40 — 16 <u>40</u> — 19	Standard for the Storage and Handling of Cellulose Nitrate Film	IBC®

45 — 1545 —19	Standard on Fire Protection Laboratories Using Chemicals (2015 Edition)	IBC®
58 — 1758 —20	Liquefied Petroleum Gas Code	IBC®
61 — 1761 —20	Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities	IBC®
72 — 1672 —19	National Fire Alarm and Signaling Code	IBC®
80 — 1680 —19	Standard for Fire Doors and Other Opening Protectives	IBC®
82 — 1482 —19	Standard on Incinerators and Waste and Linen Handling Systems and Equipment	IBC®
85 — 1585 —19	Boiler and Combustion System Hazards Code	IBC®
92 — 1592 —18	Standard for Smoke Control Systems	IBC®
99 — 1899 —21	Health Care Facilities Code	IBC®
101 — 18101 —21	Life Safety Code	IBC®
105 — 16105 —19	Standard for Smoke Door Assemblies and Other Opening Protectives	IBC®
110 — 16110 —19	Standard for Emergency and Standby Power Systems	IBC®
111 — 13111 —19	Standard on Stored Electrical Energy Emergency and Standby Power Systems	IBC®
120 — 15120 —20	Standard for Fire Prevention and Control in Coal Mines	IBC®
211 — 16211 —19	Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	IBC®
221 — 18221 —21	Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls	IBC®
253 — 15253 —19	Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	IBC®
265 — 15265 —19	Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile <u>or</u> Expanded Vinyl Wall Coverings on Full Height Panels and Walls	IBC®
286 — 15286 —19	Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	IBC®
276 — 15276 —19	Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components	IBC®
285 — 12-285 —19	Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components	IBC®
289 — 18289 —19	Standard Method of Fire Test for Individual Fuel Packages	IBC®
484 — 18484 —19	Standard for Combustible Metals	IBC®
652 — 16652 —19	Standard on the Fundamentals of Combustible Dust	IBC®
654 — 17654 —20	Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids	IBC®
664 — 17664 —20	Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	IBC®

701 — 15701 —19	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films	IBC®
750 — 15750 —19	Standard on Water Mist Fire Protection Systems	IBC®
2001 — 152001 —18	Standard on Clean Agent Fire Extinguishing Systems	IBC®
2010 — 152010 —20	Standard for Fixed Aerosol Fire-extinguishing Systems	IBC®
PCI	Precast Prestressed Concrete Institute	
Standard Reference Number	Title	Referenced in Code(s):
MNL 124 — 11 PCI 124 —18	Design Specification for Fire Resistance of Precast/Prestressed Concrete	IBC®
MNL 128 — 01 PCI 128 —19	Recommended Practice Specification for Glass Fiber Reinforced Concrete Panels	IBC®
PTI	Post-Tensioning Institute	
Standard Reference Number	Title	Referenced in Code(s):
PTI DC — 10.5 — 12 DC — 10.5 —19	Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive and Stable Soils	IBC®
SBCA	Structural Building Components Association	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/FS 400-42 — 100-12 (R2018)	Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies	IBC®
SPRI	Single-Ply Roofing Institute	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/SPRI/FM 4435-ES-1 — 44435 ES-1 —17	Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems	IBC®
ANSI/SPRI RP-4 — 13 RP-4 —18	Wind Design Guide for Ballasted Single-ply Roofing Systems	IBC®
ANSI/SPRI VF1 — 10 VF-1 —17	External Fire Design Standard for Vegetative Roofs	IBC®
TIA	Telecommunications Industry Association	
Standard Reference Number	Title	Referenced in Code(s):
222-H — 2016 ANSI/TIA 222-H — 2017	Structural Standards Standard for Antenna Supporting Structures and Antennas, Antennas and Small Wind Turbine Support Structures	IBC®
TMS	The Masonry Society	
Standard Reference Number	Title	Referenced in Code(s):
302 — 2012 302 —2018	Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls	IBC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
10A—2009	Tin Clad Fire Doors—with Revisions through December 2013 July 2018	IBC®
10C — 2009 10C —2016	Positive Pressure Fire Tests of Door Assemblies—with Revisions through February 2015Assemblies	IBC®

14B—2008	Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors—with Revisions through May 2013 <u>July 2017</u>	IBC®
14C—06 <u>14C—2006</u>	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs—with Revisions through May 2013 <u>July 2017</u>	IBC®
55A—04 <u>55A—2004</u>	Materials for Built-up Roof Coverings	IBC®
103—2010	Factory-built Chimneys, for Residential Type and Building Heating Appliances—with Revisions through July 2012 <u>March 2017</u>	IBC®
127—2011	Factory-built Fireplaces—with Revisions through May 2015 <u>July 2016</u>	IBC®
199E—04 <u>199E—2004</u>	Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers	IBC®
217—06 <u>217—2015</u>	Single and Multiple Station Smoke Alarms—with Revisions through October 2015 <u>November 2016</u>	IBC®
263—11	Fire Tests of Building Construction and Materials—with Revisions through June 2015 <u>March 2018</u>	IBC®
268—09 <u>268—2016</u>	Smoke Detectors for Fire Alarm Systems <u>Systems</u> —with revisions through <u>July 2016</u>	IBC®
294—1999 <u>294—2018</u>	Access Control System Units—with Revisions through February 2015 <u>October 2018</u>	IBC®
300—05(R2010) <u>300—2005(R2010)</u>	Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment—with Revisions through <u>December 2014</u>	IBC®
300A—06 <u>300A—2006</u>	Outline of Investigation for Extinguishing System Units for Residential Range Top Cooking Surfaces	IBC®
305—2012	Panic Hardware—with Revisions through August 2014 <u>March 2017</u>	IBC®
325—02 <u>325—2017</u>	Door, Drapery, Gate, Louver and Window Operations and Systems —with Revisions through May 2015 <u>Systems</u>	IBC®
555—2006	Fire Dampers—with Revisions through May 2014 <u>October 2016</u>	IBC®
555C—2006 <u>555C—2014</u>	Ceiling Dampers—with Revisions through December 2014 <u>May 2017</u>	IBC®
555S—99 <u>555S—2014</u>	Smoke Dampers—with Revisions through February 2014 <u>October 2016</u>	IBC®
580—2006	Test for Uplift Resistance of Roof Assemblies—with Revisions through October 2013 <u>2018</u>	IBC®
641—2010	Type L Low-temperature Venting Systems—with Revisions through June 2013 <u>April 2018</u>	IBC®
723—2008 <u>723—2018</u>	Test for Surface Burning Characteristics of Building Materials—with Revisions through August 2013 <u>Materials</u>	IBC®
790—04 <u>790—2004</u>	Standard Test Methods for Fire Tests of Roof Coverings—with Revisions through July 2014 <u>October 2018</u>	IBC®
793—08 <u>793—2008</u>	Automatically Operated Roof Vents for Smoke and Heat—with Revisions through September 2014 <u>March 2017</u>	IBC®

864 — 03 <u>864</u> —2014	Control Units and Accessories for Fire Alarm Systems—with Revisions through December 2014 March 2018	IBC®
924 — 06 <u>924</u> —2016	Safety Emergency Lighting and Power Equipment—with Revisions through April 2014 May 2018	IBC®
1040 — 96 <u>1040</u> —1996	Fire Test of Insulated Wall Construction—with Revisions through October 2012 April 2017	IBC®
1256—02	Fire Test of Roof Deck Construction—with Revisions through July 2013 August 2018	IBC®
1479 — 03 <u>1479</u> —2015	Fire Tests of Penetration Firestops—with Revisions through June 2015 Firestops	IBC®
1703 — 02 <u>1703</u> —2002	Flat-plate Photovoltaic Modules and Panels—with Revisions through October 2015 September 2018	IBC®
1715—97	Fire Test of Interior Finish Material—with Revisions through January 2013 April 2017	IBC®
1741—2010	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources—with Revisions through January 2015 February 2018	IBC®
1777—2007	Chimney Liners—with Revisions through October 2015 April 2014	IBC®
1784 — 01 <u>1784</u> —2015	Air Leakage Tests of Door Assemblies—with Revisions through February 2015 Assemblies	IBC®
1897 — 12 <u>1897</u> —2015	Uplift Tests for Roof Covering Systems—with Revisions through September 2015 Systems	IBC®
1994 — 04 <u>1994</u> —2015	Luminous Egress Path Marking Systems—with Revisions through May 2015 Systems	IBC®
2034 — 2008 <u>2034</u> —2017	Single- and Multiple-station Carbon Monoxide Alarms—with Revisions through March 2015 September 2018	IBC®
2075—2013	Standard for Gas and Vapor Detectors and Sensors Sensors-with revisions through December 2017	IBC®
2079 — 04 <u>2079</u> —2015	Tests for Fire Resistance of Building Joint Systems—with Revisions through August 2015 Systems	IBC®
2196 — 2004 <u>2196</u> —2017	Tests Standard for Fire Resistive Cables—with Revisions through March 2012 Test for Circuit Integrity of Fire- Resistive Power, Instrumentation, Control and Data Cables	IBC®
2200—2012	Stationary Engine Generator Assemblies—with Revisions through July October 2015	IBC®
2202—2009	Electric Vehicle (EV) Charging System Equipment Equipment-with revisions through February 2018	IBC®
2594 — 2013 <u>2594</u> —2016	Electric Vehicle Supply Equipment	IBC®
2703—2014	Outline of Investigation for Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-plate Photovoltaic Modules and Panels Panels-with revisions through December 2019	IBC®
ULC	Underwriters Laboratories of Canada	
Standard Reference Number	Title	Referenced in Code(s):

CAN/ULC S 402.2— 2010102.2—2018	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies— with 2000 Revisions Assemblies	IBC®
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Proposed Change as Submitted

ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):
ANSI Z21.69/CSA 6.16— 096.16—2015	Connectors for Movable Gas Appliances	IFC®
API	American Petroleum Institute	
Standard Reference Number	Title	Referenced in Code(s):
RP 651—3rd 651—4th Edition (2007)(2014)	Cathodic Protection of Aboveground Petroleum Storage Tanks	IFC®
Std 653—4th 653—5th Edition (2009)(2018)	Tank Inspection, Repair, Alteration and Reconstruction	IFC®
Std 2000—6th 2000—7th Edition (2009)(2014)	Venting Atmosphere and Low-pressure Storage Tanks: Nonrefrigerated and Refrigerated	IFC®
RP 2003—7th 2003—8th Edition (2008)(2015)	Protection Against Ignitions Arising out of Static, Lightning and Stray Currents	IFC®
Std 2015—6th 2015—8th Edition 2001 (R2006)(2018)	Requirements for Safe Entry and Clearing of Petroleum Storage Tanks	IFC®
Publ 2028 3rd Edition— (2002, R2012)R2010)	Flame Arrestors in Piping Systems	IFC®
ASCE/SEI	American Society of Civil Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ASCE/SEI 24—1424—20	Flood Resistant Design and Construction	IFC®
ASHRAE	ASHRAE	
Standard Reference Number	Title	Referenced in Code(s):
15—201615—2019	Safety Standard for Refrigeration Systems	IFC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
A13.1—2015A13.1— 2020	Scheme for the Identification of Piping Systems	IFC®
ASME A17.1— 2016A17.1—2019/CSA B44—16B44—19	Safety Code for Elevators and Escalators	IFC®
A17.3—2015A17.3— 2020	Safety Code for Existing Elevators and Escalators	IFC®
B16.18—2012B16.18— 2018	Cast Copper-Alloy Solder Joint Pressure Fittings	IFC®
B16.22—2013B16.22— 2018	Wrought Copper and Copper-alloy Solder-joint Pressure Fittings	IFC®

B31.1—2016 <u>B31.1—2020</u>	Power Piping	IFC®
B31.3—2016 <u>B31.3—2020</u>	Process Piping	IFC®
B31.4—2015 <u>B31.4—2019</u>	Pipeline Transportation Systems for Liquids and Slurries	IFC®
B31.9—2014 <u>B31.9—2020</u>	Building Services Piping	IFC®
BPVC—2015 <u>BPVC—2019</u>	ASME Boiler and Pressure Vessel Code (Sections I, II, IV, V & VI, VIII)	IFC®
ASSE	American Society of Safety Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ASSE Z359.1—2016 <u>ASSP Z359.1—2019</u>	Requirements for the ANSI/ASSE Z359 The Fall Protection Code	IFC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
B88—14 <u>B88—2016</u>	Specification for Seamless Copper Water Tube	IFC®
B251—10 <u>B251/B251M—2017</u>	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	IFC®
B280—13 <u>B280—2018</u>	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	IFC®
D56—05(2010) <u>D56—2016A</u>	Test Method for Flash Point by Tag Closed Cup Tester	IFC®
D86—15 <u>D86—2017</u>	Test Method for Distillation of Petroleum Products at Atmospheric Pressure	IFC®
D92—12b <u>D92—2018</u>	Test Method for Flash and Fire Points by Cleveland Open Cup Tester	IFC®
D93—15 <u>D93—2018</u>	Test Method for Flash Point by Pensky-Martens Closed Up Tester	IFC®
D2859—16 <u>D2859—2016</u>	Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials	IFC®
E84—2016 <u>E84—2018B</u>	Standard Test Method for Surface Burning Characteristics of Building Materials	IFC®
E108—2016 <u>E108—2017</u>	Standard Test Methods for Fire Tests of Roof Coverings	IFC®
E648—15e1 <u>E648—2017A</u>	Standard Test Method for Critical Radiant Flux of Floor-covering Systems Using a Radiant Heat Energy Source	IFC®
E1354—2016 <u>E1354—2017</u>	Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter	IFC®
E1529—14a <u>E1529—2016E1</u>	Standard Test Method for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies	IFC®
E1537—2015 <u>E1537—2016</u>	Test Method for Fire Testing of Upholstered Furniture	IFC®
E1590—13 <u>E1590—2017</u>	Test Method for Fire Testing of Mattresses	IFC®
E2404—15a <u>E2404—2017</u>	Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facing and Veneers to Assess Surface Burning Characteristics	IFC®

E2573—12 <u>E2573—2017</u>	Standard Practice for Specimen Preparation and Mounting of Site-fabricated Stretch Systems to Assess Surface Burning Characteristics	IFC®
E2579—13 <u>E2579—2015</u>	Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics	IFC®
F2200—14 <u>F2200—2017</u>	Standard Specification for Automated Vehicular Gate Construction	IFC®
BHMA	Builders Hardware Manufacturers' Association	
Standard Reference Number	Title	Referenced in Code(s):
A156.10—2014 <u>A156.10—2017</u>	American National Standard for Power-operated Pedestrian Doors	IFC®
A156.19—2013 <u>A156.19—2020</u>	American National Standard for Power Assist and Low-energy Power-operated Doors	IFC®
A156.27—2014 <u>A156.27—2019</u>	Power- and Manual-operated Revolving Pedestrian Doors	IFC®
A156.38—2014 <u>A156.38—2020</u>	Low-energy Power-operated Sliding and Folding Doors	IFC®
CGA	Compressed Gas Association	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/CGA G-13—(2015) <u>G-13—(2016)</u>	Storage and Handling of Silane and Silane Mixtures (an American National Standard)	IFC®
S-1.1—(2017) <u>S-1.1—(2011)</u>	Pressure Relief Device Standards—Part 1—Cylinders for Compressed Gases	IFC®
S-1.3—(2016) <u>S-1.3—(2008)</u>	Pressure Relief Device Standards—Part 3—Stationary Storage Containers for Compressed Gases	IFC®
FM	FM Approvals	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/FM 4996—15 <u>4996—2019</u>	Approval Standard for Classification of Pallets and Other Material Handling Products as Equivalent to Wood Pallets	IFC®
IIAR	International Institute of Ammonia Refrigeration	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/IIAR-2—2014, including Addendum A	Safe Design of Closed-Circuit ircuit Ammonia Refrigeration Refrigerating Systems	IFC®
ANSI/IIAR-7—2018 2019	Developing Operating Procedures for Closed-Circuit ircuit Ammonia Refrigeration Mechanical Refrigerating Systems	IFC®
ANSI/IIAR-8—2019 2020	Decommissioning of Closed-Circuit ircuit Ammonia Refrigeration Refrigerating Systems	IFC®
IKECA	International Kitchen Exhaust Cleaning Association	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/IKECA C10—2016	IKECA C10, Standard for the Methodology for Cleaning of Commercial Kitchen Exhaust Systems	IFC®
NEMA	National Electrical Manufacturer's Association	
Standard Reference Number	Title	Referenced in Code(s):
250—2014 <u>250—2018</u>	Enclosures for Electrical Equipment (1,000 Volt Maximum)	IFC®

NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
02 — 1602 —19	Hydrogen Technologies Code	IFC®
04 — 1504 —21	Standard for Integrated Fire Protection and Life Safety System Testing	IFC®
10 — 1810 —21	Standard for Portable Fire Extinguishers	IFC®
12 — 1512 —18	Standard on Carbon Dioxide Extinguishing Systems	IFC®
12A — 1512A —18	Standard on Halon 1301 Fire Extinguishing Systems	IFC®
13 — 1613 —19	Standard for the Installation of Sprinkler Systems	IFC®
13D — 1613D —19	Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes	IFC®
13R — 1613R —19	Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies	IFC®
14 — 1614 —19	Standard for the Installation of Standpipe and Hose Systems	IFC®
16 — 1516 —19	Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems	IFC®
17 — 1717 —20	Standard for Dry Chemical Extinguishing Systems	IFC®
17A — 1717A —20	Standard for Wet Chemical Extinguishing Systems	IFC®
20 — 1620 —19	Standard for the Installation of Stationary Pumps for Fire Protection	IFC®
24 — 1624 —19	Standard for Installation of Private Fire Service Mains and Their Appurtenances	IFC®
25 — 1725 —20	Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems	IFC®
30 — 1830 —21	Flammable and Combustible Liquids Code	IFC®
30A — 1830A —21	Code for Motor Fuel-dispensing Facilities and Repair Garages	IFC®
30B — 1530B —19	Code for the Manufacture and Storage of Aerosol Products	IFC®
31 — 1631 —20	Standard for the Installation of Oil-burning Equipment	IFC®
32 —16	Standard for Dry Cleaning Plants Drycleaning Facilities	IFC®
33 — 1633 —18	Standard for Spray Application Using Flammable or Combustible Materials	IFC®
34 — 1534 —18	Standard for Dipping, Coating and Printing Processes Using Flammable or Combustible Liquids	IFC®
40 — 1640 —19	Standard for the Storage and Handling of Cellulose Nitrate Film	IFC®
45 — 1545 —19	Standard on Fire Protection for Laboratories Using Chemicals (2015 Edition)	IFC®
51 —18	Standard for the Design and Installation of Oxygen-fuel Gas Systems for Welding, Cutting and Allied Processes	IFC®
52 — 1652 —19	Vehicular Gaseous Fuel System Code	IFC®
55 — 1655 —19	Compressed Gases and Cryogenic Fluids Code	IFC®
56 — 1756 —20	Standard for Fire and Explosion Prevention during Cleaning and Purging of Flammable Gas Piping Systems	IFC®
58 — 1758 —20	Liquefied Petroleum Gas Code	IFC®
59A — 1659A —19	Standard for the Production, Storage and Handling of Liquefied Natural Gas (LNG)	IFC®
61 — 1761 —20	Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities	IFC®
69 — 1469 —19	Standard on Explosion Prevention Systems	IFC®

72 — 1672 —19	National Fire Alarm and Signaling Code	IFC®
80 — 1680 —19	Standard for Fire Doors and Other Opening Protectives	IFC®
85 — 1585 —19	Boiler and Combustion System Hazards Code	IFC®
86 — 1586 —19	Standard for Ovens and Furnaces	IFC®
92 — 1592 —18	Standard for Smoke Control Systems	IFC®
96 — 1796 —20	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations	IFC®
99 — 1899 —21	Health Care Facilities Code	IFC®
101 — 18101 —21	Life Safety Code	IFC®
105 — 16105 —19	Standard for Smoke Door Assemblies and Other Opening Protectives	IFC®
110 — 16110 —19	Standard for Emergency and Standby Power Systems	IFC®
111 — 13111 —19	Standard on Stored Electrical Energy Emergency and Standby Power Systems	IFC®
120 — 15120 —20	Standard for Fire Prevention and Control in Coal Mines	IFC®
160 — 16160 —21	Standard for the Use of Flame Effects Before an Audience	IFC®
204 — 15204 —18	Standard for Smoke and Heat Venting	IFC®
211 — 16211 —19	Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	IFC®
241 — 18241 —19	Standard for Safeguarding Construction, Alteration and Demolition Operations	IFC®
253 — 15253 —19	Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	IFC®
260 — 18260 —19	Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture	IFC®
265 — 15265 —19	Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings in Full Height Panels and Walls	IFC®
286 — 15286 —19	Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	IFC®
289 — 18289 —19	Standard Method of Fire Test for Individual Fuel Packages	IFC®
303 — 16303 —21	Fire Protection Standard for Marinas and Boatyards	IFC®
326 — 15326 —20	Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning or Repair	IFC®
400 — 16400 —19	Hazardous Materials Code	IFC®
410 — 15410 —20	Standard on Aircraft Maintenance	IFC®
484 — 15484 —19	Standard for Combustible Metals	IFC®
652 — 16652 —19	The Fundamentals of Combustible Dust	IFC®
654 — 17654 —20	Standard for Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids	IFC®
664 — 17664 —20	Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	IFC®
701 — 15701 —19	Standard Methods of Fire Tests for Flame-propagation of Textiles and Films	IFC®
703 — 18703 —21	Standard for Fire Retardant-Wood and Fire-Retardant Coatings for Building Materials	IFC®
750 — 15750 —19	Standard on Water Mist Fire Protection Systems	IFC®
853 — 15853 —20	Installation of Stationary Fuel Cell Power Systems	IFC®

914—15914—19	Code for Fire Protection of Historic Structures	IFC®
4426—161126—21	Standard for the Use of Pyrotechnics Before a Proximate Audience	IFC®
4221—161221—19	Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems	IFC®
2001—152001—18	Standard on Clean Agent Fire Extinguishing Systems	IFC®
2010—152010—20	Standard for Fixed Aerosol Fire-extinguishing Systems	IFC®
UL	Underwriters Laboratories LLC	
Standard Reference Number	Title	Referenced in Code(s):
40C—0910C—2016	Positive Pressure Fire Tests of Door Assemblies—with revisions through February 2015Assemblies	IFC®
30—9530—1995	Metal Safety Cans—with revisions through June 2014	IFC®
58—9658—2018	Steel Underground Tanks for Flammable and Combustible Liquids—with revisions through July 1998Liquids	IFC®
87A—1587A—2015	Outline of Investigation for Power-operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent Percent—with revisions through June 2017	IFC®
442—06142—2006	Steel Aboveground Tanks for Flammable and Combustible Liquids—with revisions through August 2014	IFC®
499E—04199E—2004	Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers	IFC®
217—06217—2015	Single and Multiple Station Smoke Alarms—with revisions through October 2015November 2016	IFC®
268—09268—2016	Smoke Detectors for Fire Alarm Systems—Systems—with revisions through July 2016	IFC®
294—1999294—2018	Access Control System Units—with revisions through February 2015October 2018	IFC®
300—05(R2010)300—2005	Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment—with revisions through December 2014	IFC®
300A—06300A—2006	Outline of Investigation for Extinguishing System Units for Residential Range Top Cooking Surfaces	IFC®
305—2012	Panic Hardware—with revisions through August 2014March 2017	IFC®
325—02325—2017	Door, Drapery, Gate, Louver and Window Operators and Systems—with revisions through May 2015Systems	IFC®
499—05499—2014	Standard for Electrical Heating Appliances—with revisions through November 2014February 2017	IFC®
647—93647—1993	Standard for Unvented Kerosene-fired Room Heaters and Portable Heaters—with revisions through April 2010	IFC®
710—2012	Exhaust Hoods for Commercial Cooking Equipment—with revisions through November 2013June 2018	IFC®
723—08723—18	Standard for Test for Surface Burning Characteristics of Building Materials—with revisions through August 2013Materials	IFC®
790—04790—2004	Standard Test Methods for Fire Tests of Roof Coverings—with revisions through July 2014October 2018	IFC®
793—08793—2008	Automatically Operated Roof Vents for Smoke and Heat—with revisions through September 2011March 2017	IFC®

817 —2015	Standard for Cord Sets and Power-supply Cords—with revisions through March 2015 August 2018	IFC®
864 — 03 864 —2014	Control Units and Accessories for Fire Alarm Systems—with revisions through December 2014 March 2018	IFC®
900 — 04 900 —2015	Air Filter Units—with revisions through April 2015Units	IFC®
924 — 06 924 —2016	Standard for Safety Emergency Lighting and Power Equipment—with revisions through April 2014May 2018	IFC®
4037 — 99 1037 —2016	Antitheft Alarms and Devices—with revisions through December 2009 September 2017	IFC®
1046—2010	Grease Filters for Exhaust Ducts—with revisions through January 2012April 2017	IFC®
4275 — 05 1275 —2014	Flammable Liquid Storage Cabinets—with revisions through November 2014February 2018	IFC®
4313 — 93 1313 —2015	Standard for Nonmetallic Safety Cans for Petroleum Products—with revisions through November 2012 Products	IFC®
4315 — 95 1315 —2017	Standard for Safety for Metal Waste Paper Containers—with revisions through September 2012 Containers	IFC®
4363 — 07 1363 —2018	Relocatable Power Taps—with revisions through September 2015Taps	IFC®
1564—2015	Industrial Battery Chargers Chargers—with revisions through August 2017	IFC®
1741 — 2015 1741 —2010	Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources with revisions through February 2018	IFC®
1805—2002	Standard for Laboratory Hoods and Cabinets Cabinets—with revisions through June 2006	IFC®
1973 — 13 1973 —2018	Standard for Batteries for Use in Stationery, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications and Stationary Applications	IFC®
1994 — 04 1994 —2015	Standard for Luminous Egress Path Marking Systems—with revisions through May 2015Systems	IFC®
2017 — 08 2017 —2008	General-purpose Signaling Devices and Systems—with revisions through May 2014January 2016	IFC®
2034 — 08 2034 —2017	Single and Multiple Station Carbon Monoxide Alarms—with revisions through March 2015September 2018	IFC®
2075—2013	Standard for Gas and Vapor Detectors and Sensors Sensors—with revisions through December 2017	IFC®
2079 — 04 2079 —2015	Tests for Fire Resistance of Building Joint Systems —with revisions through August 2015Systems	IFC®
2085 — 97 2085 —1997	Protected Above-ground Tanks for Flammable and Combustible Liquids—with revisions through September 2010	IFC®
2152 — 15 2152 —2016	Outline of Investigation for Special Purpose Nonmetallic Containers and Tanks for Specific Combustible or Noncombustible Liquids	IFC®
2196 — 2001 2196 —2017	Tests for Fire Resistive Cables—with revisions through March 2012Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables	IFC®
2200—2012	Stationary Engine Generator Assemblies—with revisions through July October 2015	IFC®
2245 — 06 2245 —2006	Below-grade Vaults for Flammable Liquid Storage Tanks	IFC®

2335 — 102335 — 2010	Fire Tests of Storage Pallets—with revisions through September 2012 August 2017	IFC®
2360 — 002360 — 2000	Test Methods for Determining the Combustibility Characteristics of Plastics Used in Semi-Conductor Tool Construction— with revisions through May 2013 October 2017	IFC®
9540 — 149540 — 2016	Outline of Investigation Standard for Energy Storage Systems and Equipment	IFC®

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ACCA	Air Conditioning Contractors of America	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ACCA 1 Manual D—2016	Residential Duct Systems	IMC®
AHRI	Air-Conditioning, Heating & Refrigeration Institute	
Standard Reference Number	Title	Referenced in Code(s):
700 — 2015 700—2017	with Addendum 1: Specifications for Refrigerants	IMC®
AMCA	Air Movement and Control Association International	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/AMCA 210 — ANSI/ASHRAE 51 —0751—16	Laboratory Methods of Testing Fans for Aerodynamic Performance Rating	IMC® IMC®
ANSI/AMCA 550 —09 (Rev. 09/18)	Test Method for High Velocity Wind Driven Rain Resistant Louvers	IMC®
ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):
Z21.1 — 2010 Z21.1/CSA 1.1—2016	Household Cooking Gas Appliances	IMC®
Z21.8 —1994 (R2002)(R2012)	Installation of Domestic Gas Conversion Burners	IMC®
ASHRAE	ASHRAE	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/AMCA 210 — ANSI/ASHRAE 51 —0751—16	Laboratory Methods of Testing Fans for Aerodynamic Performance Rating	IMC® IMC®
ASHRAE —2017ASHRAE—2021	ASHRAE Fundamentals Handbook	IMC®
15 — 2016 15—2019	Safety Standard for Refrigeration Systems	IMC®
34 — 2016 34—2019	Designation and Safety Classification of Refrigerants	IMC®
62.1 — 2016 62.1—2019	Ventilation for Acceptable Indoor Air Quality	IMC®
180 — 2012 180—2018	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems	IMC® IMC®
ASME	American Society of Mechanical Engineers	

Standard Reference Number	Title	Referenced in Code(s):
A112.4.1—2009 A112.4.1—2009 (R2019)	Water Heater Relief Valve Drain Tubes	IMC®
B1.20.1—2013 B1.20.1—2019	Pipe Threads, General Purpose (Inch)	IMC®
B16.3—2016 B16.3—2021	Malleable Iron Threaded Fittings, Classes 150 & 300	IMC®
B16.5—2015 B16.5—2019	Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24	IMC®
B16.9—2012 B16.9—2018	Factory Made Wrought Steel Buttwelding Fittings	IMC®
B16.11—2016 B16.11—2021	Forged Fittings, Socket-welding and Threaded	IMC®
B16.15—2013 B16.15—2018	Cast Alloy Threaded Fittings: Classes 125 and 250	IMC®
B16.18—2012 B16.18—2018	Cast Copper Alloy Solder Joint Pressure Fittings	IMC®
B16.22—2013 B16.22—2018	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	IMC®
B16.24—2016 B16.24—2021	Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500	IMC®
B16.26—2016 B16.26—2018	Cast Copper Alloy Fittings for Flared Copper Tubes	IMC®
B16.51—2013 B16.51—2018	Copper and Copper Alloy Press-connect Pressure Fittings	IMC®
B31.5—2016 B31.5—2019	Refrigeration Piping and Heat Transfer Components	IMC®
B31.9—2014 B31.9—2020	Building Services Piping	IMC®
BPVC—2015 BPVC—2019	ASME Boiler & Pressure Vessel Code–07 Edition	IMC®
CSD-1—2016 CSD-1—2021	Controls and Safety Devices for Automatically Fired Boilers	IMC®
ASSE	American Society of Safety Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ASSE Z359.1—2016 ASSP Z359.1—2019	Requirements for ANSI/ASSE Z359 <u>The Fall Protection Code</u>	IMC®
ASSE	ASSE International	
Standard Reference Number	Title	Referenced in Code(s):
1017—2010 1017—2009	Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems	IMC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A53/A53M—2018	Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated, Welded and Seamless	IMC®
A106/A106M—44A106M—2018	Specification for Seamless Carbon Steel Pipe for High-temperature Service	IMC®
A234/A234M—45A234M—18A	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service	IMC®
A254—12A254—2010 (2018)	Specification for Copper Brazed Steel Tubing	IMC®

A420/A420M—14A420M—2016	Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-temperature Service	IMC®
B88—14B88—2016	Specification for Seamless Copper Water Tube	IMC®
B135—10B135/B135M—2017	Specification for Seamless Brass Tube	IMC®
B251—10B251/B251M—2017	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	IMC®
B280—13B280—2018	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	IMC®
B302—12B302—2017	Specification for Threadless Copper Pipe, Standard Sizes	IMC®
B813—10B813—2016	Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube	IMC®
B819—00(R2011)B819—2018	Standard Specification for Seamless Copper Tube for Medical Gas Systems	IMC®
B828—02(2010)B828—2016	Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings	IMC®
C315—07(2011)C315—2007(2016)	Specification for Clay Flue Liners and Chimney Pots	IMC®
C411—14C411—2017	Test Method for Hot-surface Performance of High-temperature Thermal Insulation	IMC®
D56—05(2010)D56—2016A	Test Method for Flash Point by Tag Closed Cup Tester	IMC®
D93—15D93—18	Test Method for Flash Point of Pensky-Martens Closed Cup Tester	IMC®
D1785—15D1785—15E1	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120	IMC®
D2235—04(2011)D2235—2004(2016)	Specifications for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings	IMC®
D2412—14D2412—2011(2018)	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-plate Loading	IMC®
D2466—15D2466—2017	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40	IMC®
D2564—12D2564—2012(2018)	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems	IMC®
D2657—07D2657—2007(2015)	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings	IMC®
D2846/D2846M—14D2846M—2017BE1	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-water Distribution Systems	IMC®
D2996—01(2007)e04D2996—2017	Specification for Filament-wound Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe	IMC®
D3261—12e1D3261—2016	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing	IMC®
E84—2016E84—2018B	Standard Test Method for Surface Burning Characteristics of Building Materials	IMC®
E119—2016E119—2018B	Test Method for Fire Tests of Building Construction and Materials	IMC®
E136—16E136—2016A	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C	IMC®
E814—13aE814—2013A(2017)	Standard Test Method for Fire Tests of Penetration Firestop Systems	IMC®

E1509—12E1509—2012(2017)	Specification for Room Heaters, Pellet Fuel-burning Type	IMC®
E2231—15E2231—2018	Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics	IMC®
F438—15F438—2017	Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40	IMC®
F876—15AF876—2018A	Specification for Cross-linked Polyethylene (PEX) Tubing	IMC®
F877—11aF877—2018A	Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-water Distribution Systems	IMC®
F1055—13F1055—2016A	Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Cross linked Polyethylene (PEX) Pipe and Tubing	IMC®
F1281—11F1281—2017	Specification for Cross-linked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe	IMC®
F1282—10F1282—2017	Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe	IMC®
F1548—01(2012)F1548—2001(2018)	Standard Specification for the Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications	IMC®
F1807—15F1807—2018	Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	IMC®
F1960—15F1960—2018	Specification for Cold-expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing	IMC®
F2080—15F2080—16	Specification for Cold-expansion Fittings with Metal Compression-sleeves for Cross-linked Polyethylene (PEX) Pipe	IMC®
F2098—08F2098—2015	Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings	IMC®
F2159—14F2159—2018	Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	IMC®
F2389—15F2389—2017A	Specification for Pressure-rated Polypropylene Piping Systems	IMC®
F2735—09F2735—2009(2016)	Standard Specification for Plastic Insert Fittings for SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing	IMC®
F2769—14F2769—2018	Polyethylene of Raised Temperature (PE-RT) Plastic Hot- and Cold-water Tubing and Distribution Systems	IMC®
AWS	American Welding Society	
Standard Reference Number	Title	Referenced in Code(s):
A5.8MA5.8/A5.8—2011A5.8: 2011-AMD1	Specifications for Filler Metals for Brazing and Braze Welding	IMC®
AWWA	American Water Work Association	
Standard Reference Number	Title	Referenced in Code(s):

C151/A21.51— 09A21.51—17	Standard for Ductile-iron Pipe, Centrifugally Cast for Water	IMC®
CSA	CSA Group	
Standard Reference Number	Title	Referenced in Code(s):
B137.2—16 B137.2—17	Polyvinylchloride (PVC) Injection-moulded Gasketed Fittings for Pressure Applications	IMC®
B137.3—16 B137.3—17	Rigid Poly (Vinyl Chloride) (PVC) Pipe for Pressure Applications	IMC®
B137.6—16 B137.6—17	Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing and Fittings for Hot- and Cold-water Distribution Systems	IMC®
B137.9—16 B137.9—17	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-pipe Systems	IMC®
B137.10—16 B137.10—17	Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Composite Pressure-pipe Systems	IMC®
ANSI/CSA/IGSHPA C448 Series—16	Design and Installation of Earth Energy Systems <u>installation of ground source heat pump systems for commercial and residential buildings</u>	IMC®
CSA C22.2 No. 248.1— M89(R2014) 218.1—13 (R2017)	Spas, Hot Tubs and Associated Equipment	IMC®
CSA C22.2 No. 236— 44236—15	Heating and Cooling Equipment	IMC®
CSA B137.1— 46 B137.1—17	Polyethylene (PE) Pipe, Tubing and Fittings for Cold- water Pressure Services	IMC®
CSA B137.5— 46 B137.5—17	Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications	IMC®
CSA B137.11— 46 B137.11—17	Polypropylene (PP-R) Pipe and Fittings for Pressure Applications	IMC®
CSA B137.18— 43 B137.18—17	Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications	IMC®
America FC1— 2012ANSI/CSA FC1— 2014	Stationary Fuel Cell Power Systems <u>Fuel cell technologies - Part 3-100: Stationary fuel cell power systems-Safety</u>	IMC®
IIAR	International Institute of Ammonia Refrigeration	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/IIAR 22014, including Addendum A	Safe Design of Closed-Circuit circuit Ammonia <u>Refrigeration Refrigerating Systems</u>	
ANSI/IIAR 320423-2017	Ammonia Refrigeration Valves	
ANSI/IIAR 4—2015—2020	Installation of Closed-Circuit circuit Ammonia <u>Refrigeration Mechanical Refrigerating Systems</u>	IMC®
ANSI/IIAR 5—2013 2019	<u>Startup Start-up</u> of Closed- Circuit circuit Ammonia Refrigeration Systems	IMC®
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
SP 58—200958—2018	Pipe Hangers and Supports—Materials Design and Manufacture, Selection, Application and Installation	IMC®
NBBI	National Board of Boiler and Pressure Vessel Inspectors	

Standard Reference Number	Title	Referenced in Code(s):
NBIC—2014 <u>NBIC—2017</u>	National Board Inspection Code, Part 3	IMC®
NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
2—162—19	Hydrogen Technologies Code	IMC®
30A—18 <u>30A—21</u>	Code for Motor Fuel-dispensing Facilities and Repair Garages	IMC®
31—16 <u>31—20</u>	Standard for the Installation of Oil-burning Equipment	IMC®
58—17 <u>58—20</u>	Liquefied Petroleum Gas Code	IMC®
69—14 <u>69—19</u>	Standard on Explosion Prevention Systems	IMC®
72—16 <u>72—19</u>	National Fire Alarm and Signaling Code	IMC®
82—14 <u>82—19</u>	Standard on Incinerators and Waste and Linen Handling Systems and Equipment	IMC®
85—15 <u>85—19</u>	Boiler and Combustion Systems Hazards Code	IMC®
91—15 <u>91—20</u>	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids	IMC®
92—15 <u>92—18</u>	Standard for Smoke Control Systems	IMC®
96—17 <u>96—20</u>	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations	IMC®
211—16 <u>211—19</u>	Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	IMC®
262—15 <u>262—19</u>	Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-handling Spaces	IMC®
286—15 <u>286—19</u>	Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	IMC®
853—15 <u>853—20</u>	Standard on Installation of Stationary Fuel <u>Cell</u> Power Plants <u>Systems</u>	IMC®
NSF	NSF International	
Standard Reference Number	Title	Referenced in Code(s):
NSF 358-1—2014 <u>NSF 358-1—2017</u>	Polyethylene Pipe and Fittings for Water-based Ground-source “Geothermal” Heat Pump Systems	IMC®
NSF 358-2—2014 <u>NSF 358-2—2017</u>	Polypropylene Pipe and Fittings for Water-based Ground-source “Geothermal” Heat Pump Systems	IMC®
SMACNA	Sheet Metal and Air Conditioning Contractors’ National Association, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
SMACNA—10	Fibrous Glass Duct Construction Standards <u>7th Edition</u>	IMC®
SMACNA/ANSI—2016	HVAC Duct Construction Standards-Metal and Flexible 4th Edition (ANSI) 2016	IMC®
SMACNA 2015	<u>SMACNA Phenolic Duct Construction Standard - 1st Edition (ANSI)</u>	IMC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
103—2010	Factory-built Chimneys, Residential Type and Building Heating Appliance—with Appliances—with revisions through July 2012 <u>March 2017</u>	IMC®

127—2011	Factory-built Fireplaces—with revisions through May 2015 July 2016	IMC®
174—04	Household Electric Storage Tank Water Heaters—with revisions through April 2015 December 2016	IMC®
180—2012	Liquid-level Indicating Gauges for Oil Burner Fuels and Other Combustible Liquids Liquids—with revisions through May 2017	IMC® IMC®
181—05	Factory-made Air Ducts and Air Connectors—with revisions through October 2008 April 2017	IMC®
181A—2013	Closure Systems for Use with Rigid Air Ducts and Air Connectors - with revisions through March 2017	IMC®
181B—2013	Closure Systems for Use with Flexible Air Ducts and Air Connectors - with revisions through March 2017	IMC®
197—10	Commercial Electric Cooking Appliances—with revisions through September 2014 January 2018	IMC®
263—2011	Standard for Fire Test of Building Construction and Materials —with revisions through June 2015 March 2018	IMC®
268—2009 268—2016	Smoke Detectors for Fire Alarm Systems Systems—with revisions through July 2016	IMC®
268A—2008	Smoke Detectors for Duct Application—with revisions through October 2014 August 2016	IMC®
343—2008 343—2017	Pumps for Oil-burning Appliances Appliances—with revisions through June 2013 Appliances	IMC®
378—06 378—2006	Draft Equipment—with revisions through June 12, 2014 September 2013	IMC®
412—2011	Refrigeration Unit Coolers—with revisions through September 2013 August 2018	IMC®
471—2010	Commercial Refrigerators and Freezers—with revisions through December 2012 November 2018	IMC®
499—05 499—2014	Electric Heating Appliances—with revisions through November 2014 February 2017	IMC®
507—2014 507—2017	Standard for Electric Fans Electric Fans—with revisions through August 2018	IMC®
508—99 508—2018	Industrial Control Equipment Equipment—with revisions through October 2013 Equipment	IMC®
536—97 536—2014	Flexible Metallic Hose—with revisions through December 2014 Hose	IMC®
555—06	Fire Dampers—with revisions through May 2014 October 2016	IMC®
555C—06 555C—2014	Ceiling Dampers—with revisions through December 2014 May 2017	IMC®
555S—99 555S—2014	Smoke Dampers—with revisions through February 2014 October 2018	IMC®
586—2009	High-efficiency, Particulate, Air Filter Units—with revisions through September 2014 December 2017	IMC®
641—2010	Type L Low-temperature Venting Systems—with revisions through June 2013 April 2018	IMC®
705—2004 705—2017	Standard for Power Ventilators —with revisions through December 2013 October 2018	IMC®
710—2012	Exhaust Hoods for Commercial Cooking Equipment—with revisions through November 2013 June 2018	IMC®
723—2008 723—2018	Standard for Test for Surface Burning Characteristics of Building Materials —with revisions through August 2013 Materials	IMC®

727—06 <u>727—2018</u>	Oil-fired Central Furnace— with revisions through October 2013 <u>Furnace</u>	IMC®
729—03 <u>729—2003</u>	Oil-fired Floor Furnaces— with revisions through October 2013 <u>November 2016</u>	IMC®
730—03 <u>730—2003</u>	Oil-fired Wall Furnaces— with revisions through October 2013 <u>November 2016</u>	IMC®
731—95 <u>731—2018</u>	Oil-fired Unit Heaters— with revisions through October 2013 <u>Heaters</u>	IMC®
732—95 <u>732—2018</u>	Oil-fired Storage Tank Water Heaters— with revisions through October 2013 <u>Heaters</u>	IMC®
737—2011	Fireplace Stoves— with revisions through August 2015 <u>Stoves</u>	IMC®
762—2010 <u>762—2013</u>	Outline of Investigation for Power Ventilators for Restaurant Exhaust Appliances— with revisions through October 2013 <u>Appliances</u>	IMC®
791—06 <u>791—2006</u>	Residential Incinerators— with revisions through November 2014	IMC®
834—04	Heating, Water Supply and Power Boilers Electric— with revisions through December 2013 <u>September 2018</u>	IMC®
842—07 <u>842—2015</u>	Valves for Flammable Fluids— with revisions through May 2015	IMC®
858—05 <u>858—2014</u>	Household Electric Ranges— with revisions through June 2015 <u>2018</u>	IMC®
867—2011	Electrostatic Air Cleaners— with revisions through August 2013 <u>2018</u>	IMC®
875—09 <u>875—2009</u>	Electric Dry Bath Heater— with revisions through December 2013 <u>September 2017</u>	IMC®
896—93 <u>896—1993</u>	Oil-burning Stoves— with revisions through November 2013 <u>2016</u>	IMC®
900—04 <u>900—2015</u>	Air Filter Units— with revisions through April 2015 <u>Units</u>	IMC®
907—94 <u>907—2016</u>	Fireplace Accessories— with revisions through June 2014 <u>Accessories</u>	IMC®
923—2013	Microwave Cooking Appliances— with revisions through June 2015 <u>July 2017</u>	IMC®
1046—2010	Grease Filters for Exhaust Ducts— with revisions through January 2012 <u>April 2017</u>	IMC®
1240—2012 <u>1240—2005</u>	Electric Commercial Clothes—Drying Equipment— with revisions through October 2012 <u>March 2018</u>	IMC®
1261—01	Electric Water Heaters for Pools and Tubs— with revisions through July 2012 <u>September 2017</u>	IMC®
1453—04 <u>1453—2016</u>	Electric Booster and Commercial Storage Tank Water Heaters— with revisions through July 2014 <u>May 2018</u>	IMC®
1479—03 <u>1479—2015</u>	Fire Tests of Through-penetration Firestops— with revisions through June 2015 <u>Penetration Firestops</u>	IMC®
1482—2011	Solid-fuel Type Room Heaters— with revisions through August 2015	IMC®
1563—2009	Standard for Electric Spas, Hot Tubs and Associated Equipment— with revisions through March 2015 <u>October 2017</u>	IMC®
1618—09 <u>1618—2015</u>	Wall Protectors, Floor Protectors and Hearth Extensions— with revisions through October 2015 <u>January 2018</u>	IMC®
1777—2007	Chimney Liners— with revisions through October 2015 <u>April 2014</u>	IMC®

1812—2013	Standard for Ducted Heat Recovery Ventilators —with revisions through April 2014 <u>July 2018</u>	IMC®
1815—2012	Standard for Nonducted Heat Recovery —with revisions through April 2014 <u>July 2018</u>	IMC®
1820—04 <u>1820—2004</u>	Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics—with revisions through May 2013 <u>July 2017</u>	IMC®
1887—04 <u>1887—2004</u>	Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics—with revisions through May 2013 <u>July 2017</u>	IMC®
1978—2010	Grease Ducts—with revisions through September 2013 <u>April 2017</u>	IMC®
1995—2011 <u>1995—2015</u>	Heating and Cooling Equipment—with revisions through July 2015 <u>August 2018</u>	IMC®
1996—2009	Electric Duct Heaters—with revisions through June 2014 <u>July 2016</u>	IMC®
2024—2011 <u>2024—2014</u>	Standard for Safety Optical-fiber and Communications Cable Raceway —with revisions through August 2015	IMC®
2043—2008 <u>2043—2013</u>	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-handling Spaces—with revisions through October 2013 <u>July 2018</u>	IMC®
2075—2013	Standard for Gas and Vapor Detectors and Sensors <u>Sensors</u> -with revisions through December 2017	IMC®
2158—97 <u>2158—2018</u>	Electric Clothes Dryers—with revisions through March 2009 <u>Dryers</u>	IMC®
2158A—2010 <u>2158A—2013</u>	Outline of Investigation for Clothes Dryer Transition Duct <u>Duct</u> -with revisions through April 2017	IMC®
2162—01 <u>2162—2014</u>	Outline of Investigation for Commercial Wood-fired Baking Ovens-Refractory Type	IMC®
2200—2012	Stationary Engine Generator Assemblies—with revisions through July <u>October</u> 2015	IMC®
2518—05 <u>2518—2016</u>	Air Dispersion System Materials <u>Systems</u>	IMC®
2523—09 <u>2523—2009</u>	Solid Fuel-fired Hydronic Heating Appliances —with <u>Appliances, Water Heaters, and Boilers</u> -with revisions through February 2013 <u>March 2018</u>	IMC®
2846—14 <u>2846—2014</u>	Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics <u>Characteristics</u> -with revisions through December 2016	IMC®

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Proposed Change as Submitted

ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
A112.1.2—2012 <u>A112.1.2—2022</u>	Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water Connection Receptors)	IPC®
A112.1.3—2000 (R2015) <u>(R2020)</u>	Air Gap Fittings for Use with Plumbing Fixtures, Appliances and Appurtenances	IPC®

A112.3.1—2007 (R2012)(R2022)	Stainless Steel Drainage Systems for Sanitary, DWV, Storm and Vacuum Applications Above and Below Ground	IPC®
ASME A112.3.4— 2013A112.3.4—2020/CSA B45.9—2013B45.9—2020	Macerating Toilet Systems and Related Components	IPC®
A112.4.1—2009A112.4.1— 2009(R2019)	Water Heater Relief Valve Drain Tubes	IPC®
A112.4.2—2015A112.4.2— 2020/CSA B45.16—15B45.16— 20	Water Closet Personal Hygiene Devices	IPC®
A112.4.3—1999 (R2010)(R2020)	Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System	IPC®
A112.4.14—2004 (R2016)(R2019)	Manually Operated, Quarter-turn Shutoff Valves for Use in Plumbing Systems	IPC®
A112.6.2—2000 (R2016)A112.6.2—2022	Framing-affixed Supports for Off-the-floor Water Closets with Concealed Tanks	IPC®
A112.6.3—2001 (R2016)A112.6.3—2019	Floor and Trench Drains	IPC®
A112.6.4—2003 (R2012)(R2020)	Roof, Deck, and Balcony Drains	IPC®
A112.6.7—2010 (R2015)(R2020)	Sanitary Floor Sinks	IPC®
A112.6.9— 2005(R2015)A112.6.9— 2005(R2020)	Siphonic Roof Drains	IPC®
A112.14.1—2003 (R2012)(R2022)	Backwater Valves	IPC®
A112.14.3—2016A112.14.3— 2021	Grease Interceptors	IPC®
A112.14.4—2001 (R2012)(R2022)	Grease Removal Devices	IPC®
A112.14.6—2010 (R2015)(R2020)	FOG (Fats, Oils and Greases) Disposal Systems	IPC®
A112.18.1—2017A112.18.1— 2020/CSA B125.1— 2017B125.1—2020	Plumbing Supply Fittings	IPC®
A112.18.2—2015A112.18.2— 2019/CSA B125.2—15B125.2— 19	Plumbing Waste Fittings	IPC®
A112.18.3—2002 (R2012)A112.18.3M—2002 (R2020)	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings	IPC®
A112.18.6—2017A112.18.6— 2021/CSA B125.6—17B125.6— 21	Flexible Water Connectors	IPC®
A112.18.9—2011A112.18.9— 2011(R2022)	Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures	IPC®
A112.19.1—2013A112.19.1— 2020/CSA B45.2—2013B45.2— 2020	Enameled Cast Iron and Enameled Steel Plumbing Fixtures	IPC®
A112.19.2—2013A112.19.2— 2020/CSA B45.1—13B45.1—20	Ceramic Plumbing Fixtures	IPC®
A112.19.3—2008A112.19.3— 2021/CSA B45.4— 08(R2013)B45.4—2021	Stainless Steel Plumbing Fixtures	IPC®

<u>A112.19.5—2017A112.19.5—2021/CSA B45.15—2017B45.15—2021</u>	Flush Valves and Spuds for Water-closets, Urinals, and Tanks	IPC®
<u>A112.19.7M—2017A112.19.7—2012/CSA B45.10—17B45.10—2012(2021)</u>	Hydromassage Bathtub Systems	IPC®
<u>A112.19.12—2014A112.19.12—2019</u>	Wall Mounted and Pedestal Mounted, Adjustable, Elevating, Tilting and Pivoting Lavatory, Sink and Shampoo Bowl Carrier Systems and Drain Waste Systems	IPC®
<u>A112.19.14—2013 (R2018)</u>	Six-liter Water Closets Equipped with a Dual Flushing Device	IPC®
<u>A112.19.15—2012 (R2017)</u>	Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors	IPC®
<u>A112.19.19—2006(R2011)A112.19.19—2021</u>	Vitreous China Nonwater Urinals	IPC®
<u>A112.21.3—1985(R2007)A112.21.3—1985(R2017)</u>	Hydrants for Utility and Maintenance Use	IPC®
<u>A112.36.2M—1991(R2012)A112.36.2M—1991(R2017)</u>	Cleanouts	IPC®
<u>ASSE 4002—20151002—2020/ASME A112.4002—2015A112.1002—2020/CSA B125.12—15B125.12—20</u>	Anti-Siphon Fill Valves	IPC® IPC®
<u>ASSE 4046—20171016—2020/ASME A112.4046—2017A112.1016—2020/CSA B125.16—2017B125.16—2020</u>	Performance Requirements for Individual Thermostatic, Pressure Balancing and Combination Control Valves for Individual Fixture Fittings	IPC® IPC®
<u>ASSE 4070—20151070—2020/ASME A112.4070—2015A112.1070—2020/CSA B125.1070—15B125.1070—20</u>	Water Temperature Limiting Devices	IPC®
<u>B1.20.1—2013B1.20.1—2019</u>	Pipe Threads, General Purpose (inch)	IPC®
<u>B16.3—2016B16.3—2021</u>	Malleable Iron Threaded Fittings Classes 150 and 300	IPC®
<u>B16.4—2016B16.4—2021</u>	Gray Iron Threaded Fittings Classes 125 and 250	IPC®
<u>B16.9—2012B16.9—2018</u>	Factory-made Wrought Steel Buttwelding Fittings	IPC®
<u>B16.11—2016B16.11—2021</u>	Forged Fittings, Socket-welding and Threaded	IPC®
<u>B16.12—2009 (R2014)(R2019)</u>	Cast-iron Threaded Drainage Fittings	IPC®
<u>B16.15—2013B16.15—2018</u>	Cast Alloy Threaded Fittings: Class 125 and 250	IPC®
<u>B16.18—2012B16.18—2018</u>	Cast Copper Alloy Solder Joint Pressure Fittings	IPC®
<u>B16.22—2013B16.22—2018</u>	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	IPC®
<u>B16.23—2016B16.23—2021</u>	Cast Copper Alloy Solder Joint Drainage Fittings DWV	IPC®
<u>B16.26—2016B16.26—2018</u>	Cast Copper Alloy Fittings for Flared Copper Tubes	IPC®
<u>B16.29—2012B16.29—2017</u>	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV)	IPC®
<u>B16.34—2015B16.34—2020</u>	Valves Flanged, Threaded and Welding End	IPC®
<u>B16.51—2013B16.51—2018</u>	Copper and Copper Alloy Press-connect Pressure Fittings	IPC®

ASSE	ASSE International	
Standard Reference Number	Title	Referenced in Code(s):
4001 — 2016 <u>1001</u> — 2017	Performance Requirements for Atmospheric Type Vacuum Breakers	IPC®
ASSE 1002—2015/ASME A112.1002—2015/CSA B125.12—15	Antisiphon <u>Anti-siphon</u> Fill Valves	IPC® IPC®
4013 — 2017 <u>1013</u> — 2011	Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers	IPC®
4017 — 2010 <u>1017</u> — 2009	Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems	IPC®
4018 — 2017 <u>1018</u> — 2001	Performance Requirements for Trap Seal Primer Valves; Potable Water Supplied	IPC®
4019 — 2016 <u>1019</u> — 2011 (R2016)	Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type	IPC®
4022 — 2016 <u>1022</u> — 2017	Performance Requirements for Backflow Preventer for Beverage Dispensing Equipment	IPC®
4024 — 2016 <u>1024</u> — 2017	Performance Requirements for Dual Check Valve Type Backflow Preventers, Anti-siphon-type, Residential Applications	IPC®
4044 — 2010 <u>1044</u> — 2015	Performance Requirements for Trap Seal Primer Devices - Drainage Types and Electronic Design Types	IPC®
4047 — 2017 <u>1047</u> — 2011	Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies	IPC®
4048 — 2017 <u>1048</u> — 2011	Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies	IPC®
4055 — 2016 <u>1055</u> — 2018	Performance Requirements for Chemical Dispensing Systems <u>with Integral Backflow Protection</u>	IPC®
4060 — 2016 <u>1060</u> — 2017	Performance Requirements for Outdoor Enclosures for Fluid Conveying Components	IPC®
4062 — 2016 <u>1062</u> — 2017	Performance Requirements for Temperature Actuated, Flow Reduction (TAFR) Valves to Individual Supply Fittings	IPC®
4066 — 2016 <u>1066</u> — 1997	Performance Requirements for Individual Pressure Balancing In-line Valves for Individual Fixture Fittings	IPC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A53/A53M — 12 <u>A53M</u> — 2018	Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated Welded and Seamless	IPC®
A74 — 15 <u>A74</u> — 17	Specification for Cast-iron Soil Pipe and Fittings	IPC®
A312/A312M — 15a <u>A312M</u> — 2018	Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes	IPC®

A733—15A733—16	Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples	IPC®
A778/A778M—15A778M—16	Specification for Welded Unannealed Austenitic Stainless Steel Tubular Products	IPC®
A888—15A888—2018	Specification for Hubless Cast-iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Application	IPC®
B88—14B88—2016	Specification for Seamless Copper Water Tube	IPC®
B251—10B251/B251M—2017	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	IPC®
B302—12B302—17	Specification for Threadless Copper Pipe, Standard Sizes	IPC®
B687—99(2014)B687—1999(2016)	Specification for Brass, Copper and Chromium-plated Pipe Nipples	IPC®
B813—10B813—16	Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube	IPC®
B828—02(2010)B828—2016	Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings	IPC®
C4—04(2014)C4—04(2018)	Specification for Clay Drain Tile and Perforated Clay Drain Tile	IPC®
C76—15aC76—2018A	Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe	IPC®
C425—04(2013)C425—2004(2018)	Specification for Compression Joints for Vitrified Clay Pipe and Fittings	IPC®
C443—12C443—2012 (2017)	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets	IPC®
C700—13C700—2018	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	IPC®
C1053—00(2010)C1053—2000(2015)	Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications	IPC®
C1173—10(2014)C1173—2018	Specification for Flexible Transition Couplings for Underground Piping System	IPC®
C1277—15C1277—2018	Specification for Shielded Coupling Joining Hubless Cast-iron Soil Pipe and Fittings	IPC®
C1440—08(2013)C1440—2017	Specification for Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste, and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems	IPC®
C1460—2012C1460—2017	Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground	IPC®
C1461—08(2013)C1461—208(2017)	Specification for Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV) Sewer, Sanitary and Storm Plumbing Systems for Above and Below Ground Use	IPC®
C1540—15C1540—2018	Specification for Heavy Duty Shielded Couplings Joining Hubless Cast-iron Soil Pipe and Fittings	IPC®
C1563—08(2013)C1563—2008(2017)	Standard Test Method for Gaskets for Use in Connection with Hub and Spigot Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, Vent and Storm Piping Applications	IPC®

D1785 — 15D1785 — 2015E1	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120	IPC®
D2235 — 04(2011)D2235 — 2004(2016)	Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings	IPC®
D2466 — 15D2466 — 2017	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40	IPC®
D2564 — 12D2564 — 2012 (2018)	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems	IPC®
D2657 — 07D2657 — 2007 (2015)	Practice for Heat Fusion-joining of Polyolefin Pipe and Fitting Waste, and Vent Pipe and Fittings	IPC®
D2661 — 14D2661 — 14E1	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings	IPC®
D2665 — 14D2665 — 2014	Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings	IPC®
D2729 — 11D2729 — 17	Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	IPC®
D2846/D2846M — 14D2846M — 2017BE1	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems	IPC®
D2855 — 96(2010)D2855 — 2015	Standard Practice for Making Solvent-cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings	IPC®
D3034 — 14aD3034 — 2016	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	IPC®
D3138 — 04(2011)D3138 — 2004(2016)	Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Non-pressure Piping Components	IPC®
D3261 — 12e1D3261 — 2016	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing	IPC®
D3311 — 11D3311 — 2017	Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns	IPC®
D4068 — 15D4068 — 2017	Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-containment Membrane	IPC®
D4551 — 12D4551 — 2017	Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-containment Membrane	IPC®
E2727 — 10e1E2727 — 2018	Standard Practice for the Assessment of Rainwater Quality	IPC®
F409 — 12F409 — 2017	Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings	IPC®
F438 — 15F438 — 2017	Specification for Socket-type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40	IPC®
F628 — 12e1F628 — 2012E2	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core	IPC®
F656 — 15F656 — 2015	Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings	IPC®

F667—12F667/F667M—2016	Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings	IPC®
F876—15aF876—2017	Specification for Cross-linked Polyethylene (PEX) Tubing	IPC®
F877—11aF877—2018A	Specification for Cross-linked Polyethylene (PEX) Hot- and Cold-water Distribution Systems	IPC®
F891—10F891—2016	Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core	IPC®
F1055—13F1055—2016A	Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Cross-linked Polyethylene Pipe and Tubing	IPC®
F1281—11F1281—2017	Specification for Cross-linked Polyethylene/Aluminum/ Cross-linked Polyethylene (PEX-AL-PEX) Pressure Pipe	IPC®
F1282—10F1282—2017	Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe	IPC®
F1412—09F1412—2016	Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage	IPC®
F1488—14F1488—2014E1	Specification for Coextruded Composite Pipe	IPC®
F1548—01(2012)F1548—2001(2018)	Standard Specification for the Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications	IPC®
F1673—10F1673—2010 (2016)	Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems	IPC®
F1807—15F1807—2018	Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	IPC®
F1866—13F1866—2018	Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings	IPC®
F1960—15F1960—2018	Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing	IPC®
F1986—01(2011)F1986—2001(2011)	Specification for Multilayer Pipe, Type 2, Compression Fittings and Compression Joints for Hot and Cold Drinking Water Systems	IPC®
F2080—15F2080—16	Specifications for Cold-expansion Fittings with Metal Compression-sleeves for Cross-linked Polyethylene (PEX) Pipe	IPC®
F2098—08F2098—2015	Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Fittings	IPC®
F2159—14F2159—2018	Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	IPC®
F2306/F2306M—14e4F2306M—2018	12" to 60" Annular Corrugated Profile-wall Polyethylene (PE) Pipe and Fittings for Gravity	IPC®

	Flow Storm Sewer and Subsurface Drainage Applications	
F2389—15 <u>F2389—2017A</u>	Specification for Pressure-rated Polypropylene (PP) Piping Systems	IPC®
F2648/F2648M—13 <u>F2648M—2017</u>	Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications	IPC®
F2735—09 <u>F2735—2009(2016)</u>	Standard Specification for Plastic Insert Fittings for SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing	IPC®
F2764/F2764M—11ae2 <u>F2764M—2018</u>	Standard Specification for 30 to 60 in. [750 to 1500 mm] Polypropylene (PP) Triple Wall Pipe and Fittings for Non-pressure Sanitary Sewer Applications	IPC®
F2769—14 <u>F2769—2018</u>	Polyethylene or Raised Temperature (PE-RT) Plastic Hot- and Cold-water Tubing and Distribution Systems	IPC®
F2831—12 <u>F2831—2012 (2017)</u>	Standard Practice for Internal Non Structural Epoxy Barrier Coating Material Used in Rehabilitation of Metallic Pressurized Piping Systems	IPC®
F2881—14 <u>F2881/F2881M—2018</u>	Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-pressure Storm Sewer Applications	IPC®
AWS	American Welding Society	
Standard Reference Number	Title	Referenced in Code(s):
A5.8MA5.8/A5.8—2011 <u>A5.8: 2011-AMD1</u>	Specifications for Filler Metals for Brazing and Braze Welding	IPC®
AWWA	American Water Works Association	
Standard Reference Number	Title	Referenced in Code(s):
C104/A21.4—13 <u>A21.4—16</u>	Cement-mortar Lining for Ductile-iron Pipe and Fittings	IPC®
C111/A21.11—12 <u>A21.11—17</u>	Rubber-gasket Joints for Ductile-iron Pressure Pipe and Fittings	IPC®
C151/A21.51—09 <u>A21.51—17</u>	Ductile-iron Pipe, Centrifugally Cast for Water	IPC®
C504—10 <u>C504—15</u>	Standard for Rubber-Seated Butterfly Valves	IPC®
C510—07 <u>C510—17</u>	Double Check Valve Backflow Prevention Assembly	IPC®
C511—07 <u>C511—17</u>	Reduced-pressure Principle Backflow Prevention Assembly	IPC®
CISPI	Cast Iron Soil Pipe Institute	
Standard Reference Number	Title	Referenced in Code(s):
301—12 <u>301—18</u>	Specification for Hubless Cast-iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications	IPC®
340—12 <u>340—18</u>	Specification for Coupling for Use in Connection with Hubless Cast-iron Soil Pipe and Fittings for	IPC®

	Sanitary and Storm Drain, Waste and Vent Piping Applications	
CSA	CSA Group	
Standard Reference Number	Title	Referenced in Code(s):
A257.1M—14 <u>A257.1—14</u>	Non-reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe and Fittings	IPC®
A257.2M—14 <u>A257.2—14</u>	Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe and Fittings	IPC®
A257.3M—14 <u>A257.3—14</u>	Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets	IPC®
ASME A112.18.1— 2017 <u>A112.18.1—2018</u> /CSA B125.1—17 <u>B125.1—18</u>	Plumbing Supply Fittings	IPC®
ASME A112.19.1— 2013 <u>A112.19.1—2018</u> /CSA B45.2—2013 <u>B45.2—2018</u>	Enameled Cast-iron and Enameled Steel Plumbing Fixtures	IPC®
ASME A112.19.2— 2013 <u>A112.19.2—2018</u> /B45.1— 2013 <u>B45.1—2018</u>	Ceramic Plumbing Fixtures	IPC®
ASME A112.19.3— 2008 <u>A112.19.3—2017</u> /CSA B45.4—08(R2013) <u>B45.4—17</u>	Stainless-steel Plumbing Fixtures	IPC®
ASME A112.19.7— 2017 <u>A112.19.7—2012</u> /CSA B45.10—17 <u>B45.10—12 (R2017)</u>	Hydromassage Bathtub Systems	IPC®
ASME A112.3.4— 2013 <u>A112.3.4—2018</u> /CSA B45.9—13 <u>B45.9—18</u>	Macerating Toilet Systems and Related Components Waste Pumping Systems for Plumbing Fixtures	IPC®
B64.1.1—16 <u>B64.1.1—11(R2016)</u>	Vacuum Breakers, Atmospheric Type (AVB)	IPC®
B64.1.2—16 <u>B64.1.2—11(R2016)</u>	Pressure Vacuum Breakers, (PVB)	IPC®
B64.1.3—16 <u>B64.1.3—11(R2016)</u>	Spill Resistant Pressure Vacuum Breakers (SRPVB)	IPC®
B64.2—16 <u>B64.2—11(R2016)</u>	Vacuum Breakers, Hose Connection Type (HCVB)	IPC®
B64.2.1—16 <u>B64.2.1—11(R2016)</u>	Vacuum Breakers, Hose Connection (HCVB) with Manual Draining Feature	IPC®
B64.2.1.1—16 <u>B64.2.1.1—11(R2016)</u>	Hose Connection Dual Check Vacuum Breakers (HCDVB)	IPC®
B64.2.2—16 <u>B64.2.2—11(R2016)</u>	Vacuum Breakers, Hose Connection Type (HCVB) with Automatic Draining Feature	IPC®
B64.3—16 <u>B64.3—11(R2016)</u>	Backflow Preventers, Dual Check Valve Type with Atmospheric Port (DCAP)	IPC®
B64.4—16 <u>B64.4—11(R2016)</u>	Backflow Preventers, Reduced Pressure Principle Type (RP)	IPC®
B64.4.1—16 <u>B64.4.1—11(R2016)</u>	Reduced Pressure Principle for Fire Sprinklers (RPF)	IPC®
B64.5—16 <u>B64.5—11(R2016)</u>	Double Check Backflow Preventers (DCVA)	IPC®
B64.5.1—16 <u>B64.5.1—11(R2016)</u>	Double Check Valve Backflow Preventer for Fire Systems (DCVAF)	IPC®
B64.6—16 <u>B64.6—11(R2016)</u>	Dual Check Valve (DuC) Backflow Preventers	IPC®
B64.7—16 <u>B64.7—11 (R2016)</u>	Laboratory Faucet Vacuum Breakers (LFVB)	IPC®

B64.10—16 <u>B64.10—17</u>	Manual for the Selection and Installation of Backflow Prevention Devices	IPC®
B64.10.1—11 <u>B64.10.1—17</u>	Maintenance and Field Testing of Backflow Preventers	IPC®
B79—08(R2013) <u>B79—08(R2018)</u>	Commercial and Residential Drains and Cleanouts	IPC®
B125.3—2012 <u>B125.3—2018</u>	Plumbing Fittings	IPC®
B137.1—16 <u>B137.1—17</u>	Polyethylene (PE) Pipe, Tubing and Fittings for Cold-water Pressure Services	IPC®
B137.2—16 <u>B137.2—17</u>	Polyvinylchloride, PVC, Injection-moulded Gasketed Fittings for Pressure Applications	IPC®
B137.3—16 <u>B137.3—17</u>	Rigid Poly (Vinyl Chloride) (PVC) Pipe for Pressure Applications	IPC®
B137.5—16 <u>B137.5—17</u>	Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications	IPC®
B137.6—16 <u>B137.6—17</u>	CPVC Pipe, Tubing and Fittings for Hot- and Cold-water Distribution Systems	IPC®
B137.9—16 <u>B137.9—17</u>	Polyethylene Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-pipe Systems	IPC®
B137.10—16 <u>B137.10—17</u>	Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Composite Pressure-pipe Systems	IPC®
B137.11—16 <u>B137.11—17</u>	Polypropylene (PP-R) Pipe and Fittings for Pressure Applications	IPC®
B137.18—13 <u>B137.18—17</u>	Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications	IPC®
B181.1—15 <u>B181.1—18</u>	Acrylonitrile-Butadiene-Styrene ABS Drain, Waste and Vent Pipe and Pipe Fittings	IPC®
B181.2—15 <u>B181.2—18</u>	Polyvinylchloride PVC and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings	IPC®
B181.3—15 <u>B181.3—18</u>	Polyolefin and Polyvinylidene Fluoride (PVDF) Laboratory Drainage Systems	IPC®
B182.1—11 <u>B182.1—18</u>	Plastic Drain and Sewer Pipe and Pipe Fittings	IPC®
B182.2—11 <u>B182.2—18</u>	PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings	IPC®
B182.4—15 <u>B182.4—18</u>	Profile Polyvinylchloride PVC Sewer Pipe and Fittings	IPC®
B182.6—15 <u>B182.6—18</u>	Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-proof Sewer Applications	IPC®
B182.8—15 <u>B182.8—18</u>	Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings	IPC®
B182.13—11 <u>B182.13—18</u>	Profile Polypropylene (PP) Sewer Pipe and Fittings for Leak-proof Sewer Applications	IPC®
B356—10 (R2015)	Water Pressure Reducing Valves for Domestic Water Systems	IPC®
B481.1—12 (R2017)	Testing and Rating of Grease Interceptors Using Lard	IPC®
B481.3—12 (R2017)	Sizing, Selection, Location and Installation of Grease Interceptors	IPC®
B483.1—07(R2012) <u>CAN/CSA B483.1—07(R2017)</u>	Drinking Water Treatment Units Systems	IPC®
B602—15 <u>B602—16</u>	Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer Pipe	IPC®

IAPMO	IAPMO Group	
Standard Reference Number	Title	Referenced in Code(s):
Z1001—2014 <u>Z1001—2016</u>	Prefabricated Gravity Grease Interceptors	IPC®
CSA B45.5—17/IAPMO Z124—2017 with errata dated August 2017	Plastic Plumbing Fixtures	IPC® IPC®
IAPMO/ANSI Z1157—2014 <u>Z1157—2014e1</u>	Ball Valves	IPC®
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
SP-71—2013 <u>SP-71—2018</u>	Gray Iron Swing Check Valves, Flanged and Threaded Ends	IPC®
SP-78—2013 <u>SP-78—2011</u>	Cast Iron Plug Valves, Flanged and Threaded Ends	IPC®
SP-110—2010a <u>SP-110—2010</u>	Ball Valves, Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends (<u>incl. a 2010 Errata Sheet</u>)	IPC®
SP-122—2012 <u>SP-122—2017</u>	Plastic Industrial Ball Valves	IPC®
NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
55—1655—19	Compressed Gases and Cryogenic Fluids Code	IPC®
99—1899—21	Health Care Facilities Code	IPC®
NSF	NSF International	
Standard Reference Number	Title	Referenced in Code(s):
3—2012 <u>3—2017</u>	Commercial Warewashing Equipment	IPC®
14—2015 <u>14—2017</u>	Plastic Piping System Components and Related Materials	IPC®
18—2012 <u>18—2016</u>	Manual Food and Beverage Dispensing Equipment	IPC®
42—2015 <u>42—2017</u>	Drinking Water Treatment Units-Aesthetic Effects	IPC®
44—2015 <u>44—2017</u>	Residential Cation Exchange Water Softeners	IPC®
50—2015 <u>50—2017</u>	Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Facilities	IPC®
53—2015 <u>53—2017</u>	Drinking Water Treatment Units—Health Effects	IPC®
58—2015 <u>58—2017</u>	Reverse Osmosis Drinking Water Treatment Systems	IPC®
61—2015 <u>61—2017</u>	Drinking Water System Components—Health Effects	IPC®
62—2015 <u>62—2017</u>	Drinking Water Distillation Systems	IPC®
350—2014 <u>350—2017a</u>	Onsite Residential and Commercial Water Reuse Treatment Systems	IPC®
359—2011 <u>359—2011(R2016)</u>	Valves for Cross-linked Polyethylene (PEX) Water Distribution Tubing Systems	IPC®
372—2011 <u>372—2016</u>	Drinking Water Systems Components—Lead Content	IPC®
TCNA	Tile Council of North America	
Standard Reference Number	Title	Referenced in Code(s):

TCNA/ANSI A118.10— 99 A118.10—14	Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin Set Ceramic Tile and Dimension Stone Installation	IPC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
399—2008 399—2017	Drinking-Water Coolers—with revisions through October 2013 August 2018	IPC®
430—2009 430—2015	Waste Disposers—with revisions through September 2015 February 2018	IPC®
508—99 508—2018	Industrial Control Equipment—with revisions through October 2013 Equipment	IPC®
1795—2009 1795—2016	Hydromassage Bathtubs—with revisions through January 2015 December 2017	IPC®

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Proposed Change as Submitted

AAMA	American Architectural Manufacturers Association	
Standard Reference Number	Title	Referenced in Code(s):
450—10 450—20	Voluntary Performance Rating Method for Muller Fenestration Assemblies	IRC®
711—16 711—20	Voluntary Specification for Self-adhering Flashing Used for Installation of Exterior Wall Fenestration Products	IRC®
714—15 714—20	Voluntary Specification for Liquid Applied Flashing Used to Create a Water-resistive Seal around Exterior Wall Openings in Buildings	IRC®
AAMA/NPEA/NSA 2100— 122 100—20	Specifications for Sunrooms	IRC®
ACCA	Air Conditioning Contractors of America	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ACCA 1 Manual D—2016	Residential Duct Systems	IRC®
ANSI/ACCA Manual J—2016	Residential Load Calculation— Eighth Edition Calculation	IRC®
ANSI/ACCA 3 Manual S—2014	Residential Equipment Selection	IRC®
ACI	American Concrete Institute	
Standard Reference Number	Title	Referenced in Code(s):
318—14 318—19	Building Code Requirements for Structural Concrete	IRC®
332—14 332—20	Residential Code Requirements for Structural Concrete	IRC®
AISI	American Iron and Steel Institute	
Standard Reference Number	Title	Referenced in Code(s):
AISI S100—16/S1-18	North American Specification for the Design of Cold-formed Steel Structural Members, 2016, with Supplement 1, dated 2018	IRC®

AISI S220—15S220—20	North American Standard for Cold-formed Steel Framing—Nonstructural Members, 2015 2020	IRC®
AISI S230—15S230—18	Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, 2015 2018	IRC®
AISI S240—15S240—20	North American Standard for Cold-Formed Steel Structural Framing, 2020	IRC®
AMCA	Air Movement and Control Association International	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/AMCA 210-ANSI/ASHRAE 51—0751—16	Laboratory Methods of Testing Fans for Aerodynamic Performance Rating	IRC®
ANCE	Association of the Electric Sector	
Standard Reference Number	Title	Referenced in Code(s):
NMX-J-521/2-40-ANCE—20142-40-ANCE—2019/CAN/CSA-22.2 No. 60335-2-40—1260335-2-40—19/UL 60335-2-4060335-2-40-2019	Safety of Household and Similar Electric Appliances, Part 2-402-40-Safety: Particular Requirements for Electric Heat Pumps, Air-Conditioners and Dehumidifiers	IRC®
ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):
A108.1A—16A108.1A—17	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar	IRC®
A108.1B—99A108.1B—2017	Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex Portland Mortar	IRC®
A108.4—99A108.4—09	Installation of Ceramic Tile with Organic Adhesives or Water-Cleanable Tile-setting Epoxy Adhesive	IRC®
A108.5—99A108.5—19	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex Portland Cement Mortar	IRC®
A108.6—99A108.6—19	Installation of Ceramic Tile with Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy	IRC®
A108.11—99A108.11—10	Interior Installation of Cementitious Backer Units	IRC®
ANSI 417—2015117—2020	Standard Specifications for Structural Glued Laminated Timber of Softwood Species	IRC®
A118.1—16A118.1—18	American National Standard Specifications for Dry-set Portland Cement Mortar	IRC®
A118.3—13A118.3—20	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy, and Water-cleanable Tile-setting Epoxy Adhesive	IRC®
A118.4—16A118.4—18	American National Standard Specifications for Modified Dry-Set Cement Mortar	IRC®
A118.10—99A118.10—14	Specification for Load-bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installation	IRC®
A136.1—08A136.1—19	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile	IRC®
A137.1—17A137.1—19	American National Standard Specifications for Ceramic Tile	IRC®

LC1/CSA 6.26—136.26—2016	Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)	IRC®
Z21.1—2010 Z21.1/CSA 1.1—2016	Household Cooking Gas Appliances	IRC®
Z21.5.1/CSA 7.1—147.1—2017	Gas Clothes Dryers—Volume I—Type I Clothes Dryers	IRC®
Z21.8—94 (R2002)(R2012)	Installation of Domestic Gas Conversion Burners	IRC®
Z21.10.1/CSA 4.1—124.1—2012	Gas Water Heaters—Volume I—Storage Water Heaters with Input Ratings of 75,000 Btu per hour or Less	IRC®
Z21.10.3/CSA 4.3—144.3—2017	Gas Water Heaters—Volume III—Storage Water Heaters with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous	IRC®
Z21.11.2—11 Z21.11.2—2016	Gas-fired Room Heaters—Volume II—Unvented Room Heaters	IRC®
Z21.13/CSA 4.9—144.9—2017	Gas-fired Low-pressure Steam and Hot Water Boilers	IRC®
Z21.15/CSA 9.1—099.1—09(R2014)	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves	IRC®
Z21.24/CSA 6.10—066.10—2015	Connectors for Gas Appliances	IRC®
Z21.40.1/CSA 2.91—96 (R2011)(R2017)	Gas-fired, Heat-activated Air-conditioning and Heat Pump Appliances	IRC®
Z21.40.2/CSA 2.92—96 (R2011)(R2017)	Gas-fired, Work Activated Air-conditioning and Heat Pump Appliances (Thermal Internal Combustion)	IRC®
Z21.42—2014 Z21.42—2013	Gas-fired Illuminating Appliances	IRC®
Z21.47/CSA 2.3—122.3—2016	Gas-fired Central Furnaces	IRC®
Z21.50/CSA 2.22—162.22—2016	Vented Decorative Gas Fireplaces	IRC®
Z21.54—2009 Z21.54—2014	Gas Hose Connectors for Portable Outdoor Gas-fired Appliances	IRC®
Z21.58—95/CSA 4.6—131.6—2015	Outdoor Cooking Gas Appliances	IRC®
Z21.60/CSA 2.26—122.26—2017	Decorative Gas Appliances for Installation in Solid Fuel-burning Fireplaces	IRC®
Z21.69/CSA 6.16—096.16—2015	Connectors for Movable Gas Appliances	IRC®
Z21.75/CSA 6.27—076.27—2016	Connectors for Outdoor Gas Appliances and Manufactured Homes	IRC®
Z21.80/CSA 6.22—116.22—2011(R2016)	Line Pressure Regulators	IRC®
ANSI/CSA FC 4—121—2014	Stationary Fuel Cell Power Systems Fuel cell technologies - Part 3-100: Stationary fuel cell power systems - Safety	IRC®
Z21.84—12 Z21.84—2017	Manually Listed Lighted , Natural Gas Decorative Gas Appliances for Installation in Solid Fuel-burning Fireplaces Solid-Fuel Burning Appliances	IRC®
Z21.86/CSA 2.32—082.32—2016	Vented Gas-fired Vented Space Heating Appliances	IRC®
Z21.91—07 Z21.91—2017	Ventless Firebox Enclosures for Gas-fired Unvented Decorative Room Heaters	IRC®
Z21.93/CSA 6.30—136.30—2017	Excess Flow Valves for Natural Gas and LP Propane Gas with Pressures up to 5 psig	IRC®
Z21.97—12 Z21.97—2014	Outdoor Decorative Gas Appliances	IRC®

Z83.8/CSA 2.6—092.6—2016	Gas-fired Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-fired Duct Furnaces	IRC®
Z83.19—01 (R2009)Z83.19—2009 (R2014)	Gas-fuel Gas-fired High-intensity Infrared Heaters	IRC®
Z83.20—08Z83.20—2016	Gas-fired Tubular and Low-intensity Infrared Heaters Outdoor Decorative Appliances	IRC®
APA	APA—The Engineered Wood Association	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/APA PRP 210—2014210—2019	Standard for Performance-rated Engineered Wood Siding	IRC®
ANSI/APA PRG 320—2017320—2019	Standard for Performance-rated Cross Laminated Timber	IRC®
ANSI/APA PRS 610.1—2013610.1—2018	Standard for Performance-Rated Structural Insulated Panels in Wall Applications	IRC®
APA E30—15E30—19	Engineered Wood Construction Guide	IRC®
APSP	The Association of Pool & Spa Professionals	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/APSP/ICC 44—201414—2019	American National Standard for Portable Electric Spa Energy Efficiency	IRC®
ANSI/APSP/ICC 45a—201415—2020	American National Standard for Residential Swimming Pool and Spa Energy Efficiency— includes Appendix A Approved January 9, 2013 Efficiency	IRC®
ASCE/SEI	American Society of Civil Engineers	
Standard Reference Number	Title	Referenced in Code(s):
7—16 with Supplement 1	Minimum Design Loads and Associated Criteria for Buildings and Other Structures	IRC®
24—1424—20	Flood-resistant Design and Construction	IRC®
ASHRAE	ASHRE	
Standard Reference Number	Title	Referenced in Code(s):
ASHRAE—2017ASHRAE—2021	ASHRAE Handbook of Fundamentals	IRC®
34—201634—2019	Designation and Safety Classification of Refrigerants	IRC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ASME A17.1—2016A17.1—2019/CSA B44—16B44—2019	Safety Code for Elevators and Escalators	IRC®
A18.1—2014A18.1—2020	Safety Standard for Platforms and Stairway Chair Lifts	IRC®
A112.1.2—2012 (R2022)	Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water Connected Receptors)	IRC®
A112.1.3—2000 (Reaffirmed 2015)2020)	Air Gap Fittings for Use with Plumbing Fixtures, Appliances and Appurtenances	IRC®
A112.3.1—2007(R2012)A112.3.1—2007(R2022)	Stainless Steel Drainage Systems for Sanitary, DWV, Storm and Vacuum Applications Above and Below Ground	IRC®

A112.3.4—2013 A112.3.4—2020/CSA B45.9—13 B45.9—20	Macerating Toilet Systems and Related Components	IRC®
A112.4.1—2009 (R2019)	Water Heater Relief Valve Drain Tubes	IRC®
ASME A112.4.2—2015 A112.4.2—2020/CSA B45.16—15 B45.16—20	Water-closet Personal Hygiene Devices	IRC® IRC®
A112.4.3—1999 (R2010) (R2020)	Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System	IRC®
A112.4.14—2004 (R2016) A112.4.14/CSA B125.14-2019	Manually Operated, Quarter-turn Shutoff Valves for Use in Plumbing Systems	IRC®
A112.6.2—2000 (R2016) A112.6.2—2022	Framing-affixed Supports for Off-the-floor Water Closets with Concealed Tanks	IRC®
A112.6.3—2001 (R2016) A112.6.3—2019	Floor and Trench Drains	IRC®
A112.14.1—03(2012) A112.14.1—2003(2022)	Backwater Valves	IRC®
A112.18.1—2017 A112.18.1—2020/CSA B125.1—2017 B125.1—2020	Plumbing Supply Fittings	IRC®
A112.18.2—2015 A112.18.2—2019/CSA B125.2—2015 B125.2—2019	Plumbing Waste Fittings	IRC®
A112.18.3—2002(R2012) A112.18.3M—2002(R2020)	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings	IRC®
A112.18.6—2017 A112.18.6—2021/CSA B125.6—17 B125.6—21	Flexible Water Connectors	IRC®
A112.19.1—2013 A112.19.1—2020/CSA B45.2—2013 B45.2—2020	Enameled Cast-iron and Enameled Steel Plumbing Fixtures	IRC®
A112.19.2—2013 A112.19.2—2020/CSA B45.1—2013 B45.1—2020	Ceramic Plumbing Fixtures	IRC®
A112.19.3—2008 A112.19.3—2021/CSA B45.4—08 (R2013) B45.4—2021	Stainless Steel Plumbing Fixtures	IRC®
A112.19.5—2017 A112.19.5—2021/CSA B45.15—2017 B45.15—2021	Flush Valves and Spuds for Water-closets, Urinals and Tanks	IRC®
A112.19.7—2017 A112.19.7—2021/CSA B45.10—2017 B45.10—2021	Hydromassage Bathtub Systems	IRC® IRC®
A112.19.12—2014 A112.19.12—2019	Wall-mounted and Pedestal-mounted, Adjustable, Elevating, Tilting, and Pivoting Lavatory and Sink, and Shampoo Bowl Carrier Systems and Drain Waste Systems	IRC®
A112.19.14—2013 (R2018)	Six-Liter Water Closets Equipped with Dual Flushing Device	IRC®
A112.19.15—2012 (R2017)	Bathtub/Whirlpool Bathtubs with Pressure-sealed Doors	IRC®
A112.36.2m—1991 (R2012) A112.36.2M—1991 (R2017)	Cleanouts	IRC®

ASSE 4002—2015 <u>1002—2020/ASME A112.4002—2015</u> A112.1002—2020/CSA B125.12—15 <u>B125.12—20</u>	Anti-Siphon Fill Valves	IRC® IRC® IRC®
B1.20.1—2013 <u>B1.20.1—2019</u>	Pipe Threads, General-purpose (Inch)	IRC®
B16.3—2016 <u>B16.3—2021</u>	Malleable-iron-threaded Fittings, 150 and 300	IRC®
B16.4—2016 <u>B16.4—2021</u>	Gray-iron-threaded Fittings	IRC®
B16.9—2012 <u>B16.9—2018</u>	Factory-made, Wrought-steel Buttwelding Fittings	IRC®
B16.11—2016 <u>B16.11—2021</u>	Forged Fittings, Socket-welding and Threaded	IRC®
B16.12—2009 (R2014) <u>(R2019)</u>	Cast-iron-threaded Drainage Fittings	IRC®
B16.15—2013 <u>B16.15—2018</u>	Cast-Alloy-threaded Fittings: Classes 125 and 250	IRC®
B16.18—2012 <u>B16.18—2018</u>	Cast-copper-alloy Solder Joint Pressure Fittings	IRC®
B16.22—2013 <u>B16.22—2018</u>	Wrought-copper and Copper-alloy Solder Joint Pressure Fittings	IRC®
B16.23—2016 <u>B16.23—2021</u>	Cast-copper-alloy Solder Joint Drainage Fittings (DWV)	IRC®
B16.26—2016 <u>B16.26—2018</u>	Cast-copper-alloy Fittings for Flared Copper Tubes	IRC®
B16.29—2012 <u>B16.29—2017</u>	Wrought-copper and Wrought-copper-alloy Solder Joint Drainage Fittings (DWV)	IRC®
B16.33—2012 (R2017)	Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes 1/2 through 2)	IRC®
B16.34—2015 <u>B16.34—2020</u>	Valves—Flanged, Threaded and Welding End	IRC®
B16.44—2012 (R2017)	Manually Operated Metallic Gas Valves for Use in Above-ground Piping Systems up to 5 psi	IRC®
B16.51—2013 <u>B16.51—2018</u>	Copper and Copper Alloy Press-Connect Pressure Fittings	IRC®
B36.10M—2004 (R2015) <u>B36.10M—2018</u>	Welded and Seamless Wrought-steel Pipe	IRC®
BPVC—2015 <u>BPVC—2019</u>	ASME Boiler and Pressure Vessel Code (Sections I, II, IV, V, VI and VIII)	IRC®
GSD-1—2016 <u>CSD-1—2021</u>	Controls and Safety Devices for Automatically Fired Boilers	IRC®
ASSE 4046—2017 <u>1016—2020/ASME 442.4046—2017</u> 112.1016—2020/CSA B125.16—2017 <u>B125.16—2020</u>	Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations	IRC® IRC® IRC®
ASSE 4070—2015 <u>1070—2020/ASME A112.4070—2015</u> A112.1070—2020/CSA B125.70—15 <u>B125.70—20</u>	Performance Requirements for Water-temperature-limiting Devices	IRC® IRC® IRC®
ASSE	ASSE International	
Standard Reference Number	Title	Referenced in Code(s):
4001—2016 <u>1001—2017</u>	Performance Requirements for Atmospheric-type Vacuum Breakers	IRC®
ASSE 4002—2015 <u>1002—2020/ASME A112.4002—2015</u> A112.1002—2020/CSA B125.12—15 <u>B125.12—20</u>	Anti-Siphon Fill Valves	IRC® IRC® IRC®

4013—2017 <u>1013—2011</u>	Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers	IRC®
ASSE 4016—2017 <u>1016—2020/ASME 112.1016—2017</u> <u>112.1016—2020/CSA B125.16—2017</u> <u>B125.16—2020</u>	Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations	IRC® IRC® IRC®
4017—2010 <u>1017—2009</u>	Performance Requirements for Temperature-actuated Mixing Valves for Hot Water Distribution Systems	IRC®
4018—2017 <u>1018—2001</u>	Performance Requirements for Trap Seal Primer Valves; Potable Water Supplied	IRC®
4019—2016 <u>1019—2011 (R2016)</u>	Performance Requirements for Freeze-resistant, Wall Hydrants, Vacuum Breaker, Draining Types	IRC®
4023—2016 <u>1023—1979</u>	Performance Requirements for Hot Water Dispensers, Household-storage-type—Electrical	IRC®
4024—2016 <u>1024—2017</u>	Performance Requirements for Dual Check Backflow Preventers, Anti-siphon-type, Residential Applications	IRC®
4044—2010 <u>1044—2015</u>	Performance Requirements for Trap Seal Primer Devices - Drainage Types and Electronic Design Types	IRC®
4047—2017 <u>1047—2011</u>	Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies	IRC®
4048—2017 <u>1048—2011</u>	Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies	IRC®
4062—2016 <u>1062—2017</u>	Performance Requirements for Temperature-actuated, Flow Reduction (TAFR) Valves for Individual Supply Fittings	IRC®
4066—2016 <u>1066—1997</u>	Performance Requirements for Individual Pressure Balancing In-line Valves for Individual Fixture Fittings	IRC®
ASSE 4070—2015 <u>1070—2020/ASME A112.1070—2015</u> <u>A112.1070—2020/CSA B125.70—15</u> <u>B125.70—20</u>	Performance Requirements for Water-temperature-limiting Devices	IRC® IRC® IRC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A53/A53M—12 <u>A53M—2018</u>	Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated Welded and Seamless	IRC®
A74—15 <u>A74—2017</u>	Specification for Cast-iron Soil Pipe and Fittings	IRC®
A106/A106M—14 <u>A106M—2018</u>	Specification for Seamless Carbon Steel Pipe for High-temperature Service	IRC®
A123/A123M—15 <u>A123M—2017</u>	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	IRC®
A153/A153M—09 <u>A153M—2016A</u>	Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware	IRC®
A240/A240M—15 <u>AA240M—17</u>	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and	IRC®

	Strip for Pressure Vessels and for General Applications	
A254—12 <u>A254—2010(2018)</u>	Specification for Copper Brazed Steel Tubing	IRC®
A268—2010 <u>A268/A268M—2010(16)</u>	Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service	IRC®
A269—2015 <u>A269/A269M—2015A</u>	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service	IRC®
A307—14 <u>A307—2014E1</u>	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength	IRC®
A312/A312M—15A <u>A312M—2018</u>	Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes	IRC®
A653/A653M—15A <u>A653M—2017</u>	Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-iron Alloy-coated (Galvannealed) by the Hot-dip Process	IRC®
A706/A706M—15A <u>A706M—2016</u>	Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement	IRC®
A755/A755M—2015 <u>A755M—2016E1</u>	Specification for Steel Sheet, Metallic Coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products	IRC®
A778/A778M—15A <u>A778M—2016</u>	Specification for Welded Unannealed Austenitic Stainless Steel Tubular Products	IRC®
A888—15A <u>A888—2018</u>	Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Application	IRC®
A924/A924M—14A <u>A924M—2017A</u>	Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process	IRC®
A996/A996M—15A <u>A996M—2016</u>	Specifications for Rail-steel and Axle-steel Deformed Bars for Concrete Reinforcement	IRC®
B88—14 <u>B88—2016</u>	Specification for Seamless Copper Water Tube	IRC®
B135—10 <u>B135/B135M—2017</u>	Specification for Seamless Brass Tube	IRC®
B251—10 <u>B251/B251M—2017</u>	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	IRC®
B302—12 <u>B302—2017</u>	Specification for Threadless Copper Pipe, Standard Sizes	IRC®
B695—04(2009) <u>B695—2004(2016)</u>	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel	IRC®
B813—10 <u>B813—2016</u>	Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube	IRC®
B828—02(2010) <u>B828—2016</u>	Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings	IRC®
C4—04(2014) <u>C4—2004(2018)</u>	Specification for Clay Drain Tile and Perforated Clay Drain Tile	IRC®
C5—10 <u>C5—2018</u>	Specification for Quicklime for Structural Purposes	IRC®
C27—98(2013) <u>C27—1998(2018)</u>	Specification for Standard Classification of Fireclay and High-alumina Refractory Brick	IRC®
C33/C33M—13 <u>C33M—2018</u>	Specification for Concrete Aggregates	IRC®

C34 — 13 <u>C34</u> —2017	Specification for Structural Clay Load-bearing Wall Tile	IRC®
C55 —2014 <u>AC55</u> —2017	Specification for Concrete Building Brick	IRC®
C56 — 13 <u>C56</u> —2013(2017)	Standard Specification for Structural Clay Nonloadbearing Tile	IRC®
C62 — 13 <u>AC62</u> —2017	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)	IRC®
C73 — 14 <u>C73</u> —2017	Specification for Calcium Silicate Face Brick (Sand Lime Brick)	IRC®
C76 — 15 <u>AC76</u> —2018A	Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe	IRC®
C90 — 14 <u>C90</u> —2016A	Specification for Load-bearing Concrete Masonry Units	IRC®
C91 / C91M — 12 <u>C91M</u> —2018A	Specification for Masonry Cement	IRC®
C94 / C94M — 15 <u>AC94M</u> —2017A	Standard Specification for Ready-mixed Concrete	IRC®
C126 — 15 <u>C126</u> —2017	Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	IRC®
C129 — 14 <u>AC129</u> —2017	Specification for Nonload-bearing Concrete Masonry Units	IRC®
C143 / C143M — 15 <u>C143M</u> —15A	Test Method for Slump of Hydraulic Cement Concrete	IRC®
C150 / C150M — 15 <u>C150M</u> —2018	Specification for Portland Cement	IRC®
C199 —84(2011) <u>C199</u> —1984(2016)	Test Method for Pier Test for Refractory Mortar	IRC®
C203 —05a(2012) <u>C203</u> —2005A(2017)	Standard Test Methods for Breaking Load and Flexural Properties of Block-type Thermal Insulation	IRC®
C207 —06(2011) <u>C207</u> —2018	Specification for Hydrated Lime for Masonry Purposes	IRC®
C208 —12 <u>C208</u> —2012(2017)E1	Specification for Cellulosic Fiber Insulating Board	IRC®
C212 —14 <u>C212</u> —2017	Standard Specification for Structural Clay Facing Tile	IRC®
C216 —15 <u>C216</u> —2017A	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)	IRC®
C315 —07(2011) <u>C315</u> —2007(2016)	Specification for Clay Flue Liners and Chimney Pots	IRC®
C411 —11 <u>C411</u> —2017	Test Method for Hot-surface Performance of High-temperature Thermal Insulation	IRC®
C425 —04(2013) <u>C425</u> —2004(2018)	Specification for Compression Joints for Vitrified Clay Pipe and Fittings	IRC®
C443 —12 <u>C443</u> —2012(2017)	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets	IRC®
C475 / C475M —15 <u>C475M</u> —2017	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard	IRC®
C476 —10 <u>C476</u> —2018	Specification for Grout for Masonry	IRC®
C503 / C503M —2010 <u>C503M</u> —2015	Standard Specification for Marble Dimension Stone	IRC®
C552 —15 <u>C552</u> —2017E1	Standard Specification for Cellular Glass Thermal Insulation	IRC®
C557 —03(2009)e01 <u>C557</u> —2003(2017)	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing	IRC®

C568/C568M—2010 <u>C568M—2015</u>	Standard Specification for Limestone Dimension Stone	IRC®
C578—15 <u>C578—2018</u>	Specification for Rigid, Cellular Polystyrene Thermal Insulation	IRC®
C587—04(2014) <u>C587—2004(2018)</u>	Specification for Gypsum Veneer Plaster	IRC®
C595/C595M—14E1 <u>C595M—2018</u>	Specification for Blended Hydraulic Cements	IRC®
C615/C615M—11 <u>C615M—2018E1</u>	Standard Specification for Granite Dimension Stone	IRC®
C616/C616M—10 <u>C616M—2015</u>	Standard Specification for Quartz-based Dimension Stone	IRC®
C629/C629M—10 <u>C629M—2015</u>	Standard Specification for Slate Dimension Stone	IRC®
C645—14 <u>C645—2018</u>	Specification for Nonstructural Steel Framing Members	IRC®
C652—15 <u>C652—2017A</u>	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)	IRC®
C685/C685M—14 <u>C685M—2017</u>	Specification for Concrete Made by Volumetric Batching and Continuous Mixing	IRC®
C700—13 <u>C700—2018</u>	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated	IRC®
C726—12 <u>C726—2017</u>	Standard Specification for Mineral Wool Roof Insulation Board	IRC®
C728—15 <u>C728—2017A</u>	Standard Specification for Perlite Thermal Insulation Board	IRC®
C744—14 <u>C744—2016</u>	Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units	IRC®
C836/C836M—15 <u>C836M—2018</u>	Specification for High Solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course	IRC®
C841—03(2013) <u>C841—2003(2018)</u>	Standard Specification for Installation of Interior Lathing and Furring	IRC®
C843—99(2012) <u>C843—2017</u>	Specification for Application of Gypsum Veneer Plaster	IRC®
C847—14A <u>C847—2018</u>	Specification for Metal Lath	IRC®
C920—14A <u>C920—2018</u>	Standard Specification for Elastomeric Joint Sealants	IRC®
C926—15B <u>C926—2018B</u>	Specification for Application of Portland Cement-based Plaster	IRC®
C933—14 <u>C933—2018</u>	Specification for Welded Wire Lath	IRC®
C946—10 <u>C946—2018</u>	Standard Practice for Construction of Dry-Stacked, Surface-Bonded Walls	IRC®
C954—15 <u>C954—2018</u>	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in (0.84 mm) or to 0.112 in. (2.84 mm) in Thickness	IRC®
C957/C957M—15 <u>C957M—2017</u>	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Integral Wearing Surface	IRC®
C1002—14 <u>C1002—2018</u>	Specification for Steel Self-piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs	IRC®
C1032—14 <u>C1032—2018</u>	Specification for Woven Wire Plaster Base	IRC®

C1063—15AC1063—2018B	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-based Plaster	IRC®
C1088—14C1088—2018	Standard Specification for Thin Veneer Brick Units Made from Clay or Shale	IRC®
C1107/C1107M—14AC1107M—2017	Standard Specification for Packaged Dry, Hydraulic-cement Grout (Nonshrink)	IRC®
C1157—11/C1157M—14C1157M—2017	Standard Performance Specification for Hydraulic Cement	IRC®
C1167—11C1167—2011(2017)	Specification for Clay Roof Tiles	IRC®
C1173—10(2014)C1173—2018	Specification for Flexible Transition Couplings for Underground Piping Systems	IRC®
C1177/C1177M—13C1177M—2017	Specification for Glass Mat Gypsum Substrate for Use as Sheathing	IRC®
C1178/C1178M—13C1178M—2018	Specification for Glass Mat Water-resistant Gypsum Backing Panel	IRC®
C1186—08(2012)C1186—2008(2016)	Specification for Flat Fiber Cement Sheets	IRC®
C1261—13C1261—2013(2017)E1	Specification for Firebox Brick for Residential Fireplaces	IRC®
C1277—15C1277—2018	Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings	IRC®
C1278/C1278M—07a(2011)C1278M—2017	Specification for Fiber-reinforced Gypsum Panels	IRC®
C1283—11C1283—2015	Practice for Installing Clay Flue Lining	IRC®
C1288—14C1288—2017	Standard Specification for Discrete Nonasbestos Fiber-cement Interior Substrate Sheets	IRC®
C1289—15C1289—2018	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	IRC®
C1325—14C1325—2018	Standard Specification for Nonasbestos Fiber-mat Reinforced Cement Interior Substrate Sheets Backer Units	IRC®
C1364—10BC1364—2017	Standard Specification for Architectural Cast Stone	IRC®
C1396/C1396M—2014AC1396M—2017	Specification for Gypsum Board	IRC®
C1405—15C1405—2016	Standard Specification for Glazed Brick (Single Fired, Brick Units)	IRC®
C1440—08(2013)C1440—2017	Specification for Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems	IRC®
C1460—2012C1460—2017	Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground	IRC®
C1461—08(2013)C1461—2008(2017)	Specification for Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV) Sewer, Sanitary and Storm Plumbing Systems for Above and Below Ground Use	IRC®
C1492—03(2009)C1492—2003(2016)	Specification for Concrete Roof Tile	IRC®
C1513—2013C1513—2018	Standard Specification for Steel Tapping Screws for Cold-formed Steel Framing Connections	IRC®

C1540 — 15C1540 —2018	Specification for Heavy Duty Shielded Couplings Joining Hubless Cast-iron Soil Pipe and Fittings	IRC®
C1634 — 15C1634 —2017	Standard Specification for Concrete Facing Brick	IRC®
C1658/C1658M — 13C1658M —2018	Standard Specification for Glass Mat Gypsum Panels	IRC®
C1670/1670M — 161670M —2018	Standard Specification for Adhered Manufactured Stone Masonry Veneer Units	IRC®
C1691 — 11C1691 —2011(2017)	Standard Specification for Unreinforced Autoclaved Aerated Concrete (AAC) Masonry Units	IRC®
C1693 — 11C1693 —2011(2017)	Standard Specification for Autoclaved Aerated Concrete (AAC)	IRC®
C1766 — 13C1766 —2015	Standard Specification for Factory-Laminated Gypsum Panel Products	IRC®
D41/D41M — 2011D41M —2011(2016)	Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing	IRC®
D43/D43M — 2000(2012)E1D43M —2000(2018)	Specification for Coal Tar Primer Used in Roofing, Dampproofing and Waterproofing	IRC®
D226/D226M — 09D226M —2017	Specification for Asphalt-saturated (Organic Felt) Used in Roofing and Waterproofing	IRC®
D227/D227M — 03(2011)e1D227M —2003(2018)	Specification for Coal Tar Saturated (Organic Felt) Used in Roofing and Waterproofing	IRC®
D312/D321M — 15D321M —2016M	Specification for Asphalt Used in Roofing	IRC®
D449/D449M — 03(2014)E1D449M —2003(2014)E1	Specification for Asphalt Used in Dampproofing and Waterproofing	IRC®
D450/D450M — 07(2013)E1D450M —2017(2018)	Specification for Coal-tar Pitch Used in Roofing, Dampproofing and Waterproofing	IRC®
D1248 — 12D1248 —2016	Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable	IRC®
D1785 — 15D1785 —15E1	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120	IRC®
D1863/D1863M — 05(2011)e1D1863M —2005(2018)	Specification for Mineral Aggregate Used in Built-up Roofs	IRC®
D1970/D1970M — 2015AD1970M —2017A	Specification for Self-adhering Polymer Modified Bitumen Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection	IRC®
D2178/D2178M — 15D2178M —15A	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	IRC®
D2235 — 04(2011)D2235 —2004(2016)	Specification for Solvent Cement for Acrylonitrile-butadiene-styrene (ABS) Plastic Pipe and Fittings	IRC®
D2412 — 11D2412 —2011(2018)	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-plate Loading	IRC®
D2466 — 15D2466 —2017	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40	IRC®
D2513 — 2014e1D2513 —2018A	Specification for Gas Pressure Pipe, Tubing and Fittings	IRC®
D2564 — 12D2564 —2012(2018)	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems	IRC®
D2657 — 07D2657 —2007(2015)	Standard Practice for Heat Fusion-joining of Polyolefin Pipe Fittings	IRC®

D2661—14 <u>D2661—2014E1</u>	Specification for Acrylonitrile-butadiene-styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings	IRC®
D2729—11 <u>D2729—2017</u>	Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	IRC®
D2822/D2822M—05(2011)e+ <u>D2822M—2005(2011)</u>	Specification for Asphalt Roof Cement, Asbestos Containing	IRC®
D2824/D2824M—2013 <u>D2824M—2018</u>	Specification for Aluminum-pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered and Fibered without Asbestos	IRC®
D2846/D2846M—14 <u>D2846M—2017BE1</u>	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-water Distribution Systems	IRC®
D2855—96(2010) <u>D2855—2015</u>	Standard Practice for Making Solvent-cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings	IRC®
D2898—10 <u>D2898—2010(2017)</u>	Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing	IRC®
D3019—08 <u>D3019/D3019—2017</u>	Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered and Nonasbestos Fibered	IRC®
D3034—14a <u>D3034—2016</u>	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	IRC®
D3138—04(2011) <u>D3138—2004(2016)</u>	Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Non-Pressure Piping Components	IRC®
D3161/D3161M—15 <u>D3161M—2016A</u>	Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan Induced Method)	IRC®
D3261—12E+ <u>D3261—2016</u>	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing	IRC®
D3311—11 <u>D3311—2017</u>	Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns	IRC®
D3462/D3462M—10A <u>D3462M—2016</u>	Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules	IRC®
D3679—13 <u>D3679—2017</u>	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding	IRC®
D3737—2012 <u>D3737—2018E1</u>	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)	IRC®
D4068—15 <u>D4068—2017</u>	Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water Containment Membrane	IRC®
D4318—10E+ <u>D4318—2017E1</u>	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils	IRC®
D4434/D4434M—12 <u>D4434M—2015</u>	Specification for Poly (Vinyl Chloride) Sheet Roofing	IRC®
D4479/D4479M—07(2012)e+ <u>D4479M—2007(2018)</u>	Specification for Asphalt Roof Coatings— asbestos-free	IRC®
D4551—12 <u>D4551—2017</u>	Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-containment Membrane	IRC®
D4586/D4586M—07(2012)e+ <u>D4586M—2007(2018)</u>	Specification for Asphalt Roof Cemen—asbestos-free	IRC®

D4637/D4637M—14E1D4637M—2015	Specification for EPDM Sheet Used in Single-ply Roof Membrane	IRC®
D4869/D4869M—15D4869M—2016A	Specification for Asphalt-saturated (Organic Felt) Underlayment Used in Steep Slope Roofing	IRC®
D4897/D4897M—01(2009)D4897M—2016	Specification for Asphalt Coated Glass-fiber Venting Base Sheet Used in Roofing	IRC®
D5055—13E1D5055—2016	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists	IRC®
D5456—14BD5456—2018	Standard Specification for Evaluation of Structural Composite Lumber Products	IRC®
D5516—09D5516—2018	Test Method for Evaluating the Flexural Properties of Fire-retardant-treated Softwood Plywood Exposed to the Elevated Temperatures	IRC®
D5643/D5643M—06(2012)e1D5643M—2006(2018)	Specification for Coal Tar Roof Cement Asbestos-free	IRC®
D5664—10D5664—2017	Test Methods For Evaluating the Effects of Fire-retardant Treatments and Elevated Temperatures on Strength Properties of Fire-retardant-treated Lumber	IRC®
D6083—05e01D6083/D6083M—2018	Specification for Liquid-applied Acrylic Coating Used in Roofing	IRC®
D6162/D6162M—2000a(2015)E1D6162M—2016	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	IRC®
D6163/D6163M—2000(2015)E1D6163M—2016	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements	IRC®
D6164/D6164M—11D6164M—2016	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements	IRC®
D6222/D6222M—11D6222M—2016	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements	IRC®
D6223/D6223M—02(2009)E1D6223M—2016	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement	IRC®
D6298—13D6298/D6298M—2016	Specification for Fiberglass-reinforced Styrene Butadiene Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface	IRC®
D6380/D6380—03(2013)E1D6380M—2003(2018)	Standard Specification for Asphalt Roll Roofing (Organic Felt)	IRC®
D6464—03a(2009)e1D6464—2003A(2017)	Standard Specification for Expandable Foam Adhesives for Fastening Gypsum Wallboard to Wood Framing	IRC®
D6694/D6694M—08(2013)E1D6694M—2015	Standard Specification for Liquid-applied Silicone Coating Used in Spray Polyurethane Foam Roofing Systems	IRC®
D6754/D6754M—10D6754M—2015	Standard Specification for Ketone-ethylene-ester-based Sheet Roofing	IRC®
D6757—2013D6757/D6757M—2018	Specification for Underlayment Felt Containing Inorganic Fibers Used with Steep Slope Roofing	IRC®

D6841—08 <u>D6841—2016</u>	Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-retardant-treated Lumber	IRC®
D6878/D6878M—13 <u>D6878M—2017</u>	Standard Specification for Thermoplastic-polyolefin-based Sheet Roofing	IRC®
D6947/D6947M—07(2013) <u>E1D6947M—2016</u>	Standard Specification for Liquid Applied Moisture Cured Polyurethane Coating Used in Spray Polyurethane Foam Roofing System	IRC®
D7032—14 <u>D7032—2017</u>	Standard Specification for Establishing Performance Ratings for Wood-plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)	IRC®
D7158—D7158M—2016 <u>D7158/D7158M—2019</u>	Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)	IRC®
D7254—15 <u>D7254—2017</u>	Standard Specification for Polypropylene (PP) siding	IRC®
D7672—14 <u>D7672—2014</u> <u>E1</u>	Standard Specification for Evaluating Structural Capacities of Rim Board Products and Assemblies	IRC®
D7793—13 <u>D7793—2017</u>	Standard Specification for Insulated Vinyl Siding	IRC®
E84—2016 <u>E84—2018</u> <u>B</u>	Standard Test Method for Surface Burning Characteristics of Building Materials	IRC®
E96/E96M—2015 <u>E96M—2016</u>	Test Method for Water Vapor Transmission of Materials	IRC®
E108—2016 <u>E108—2017</u>	Test Methods for Fire Tests of Roof Coverings	IRC®
E119—2016 <u>E119—2018</u> <u>B</u>	Test Methods for Fire Tests of Building Construction and Materials	IRC®
E136—2016 <u>E136—2016</u> <u>A</u>	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	IRC®
E283—04(2012) <u>E283—2004(2012)</u>	Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences across the Specimen	IRC®
E331—00(2009) <u>E331—2000(2016)</u>	Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference	IRC®
E779—10 <u>E779—2010(2018)</u>	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	IRC®
E814—2013 <u>AE814—2013A(2017)</u>	Standard Test Method for Fire Tests of Penetration Firestop Systems	IRC®
E970—14 <u>E970—2017</u>	Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source	IRC®
E1509—12 <u>E1509—2012(2017)</u>	Standard Specification for Room Heaters, Pellet Fuel-burning Type	IRC®
E1602—03(2010) <u>e1E1602—2003(2017)</u>	Guide for Construction of Solid Fuel Burning Masonry Heaters	IRC®
E1827—11 <u>E1827—2011(2017)</u>	Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door	IRC®
E1886—13 <u>AE1886—2013A</u>	Test Method for Performance Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials	IRC®

E1996—2014a <u>E1996—2017</u>	Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes	IRC®
E2231—15 <u>E2231—2018</u>	Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics	IRC®
E2273—03(2011) <u>E2273—2018</u>	Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies	IRC®
E2568—09e1 <u>E2568—2017A</u>	Standard Specification for PB Exterior Insulation and Finish Systems	IRC®
E2634—11(2015) <u>E2634—2018</u>	Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems	IRC®
F409—12 <u>F409—2017</u>	Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings	IRC®
F438—15 <u>F438—2017</u>	Specification for Socket-type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40	IRC®
F628—12E1 <u>F628—2012E2</u>	Specification for Acrylonitrile-butadiene-styrene (ABS) Schedule 40 Plastic Drain, Waste and Vent Pipe with a Cellular Core	IRC®
F656—15 <u>F656—2015</u>	Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride)(PVC) Plastic Pipe and Fittings	IRC®
F876—15A <u>F876—2017</u>	Specification for Cross-linked Polyethylene (PEX) Tubing	IRC®
F877—2011A <u>F877—2018A</u>	Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-water Distribution Systems	IRC®
F891—10 <u>F891—2016</u>	Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core	IRC®
F1055—13 <u>F1055—2016A</u>	Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene Pipe and Tubing	IRC®
F1281—11 <u>F1281—2017</u>	Specification for Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Pressure Pipe	IRC®
F1282—10 <u>F1282—2017</u>	Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe	IRC®
F1412—09 <u>F1412—2016</u>	Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage	IRC®
F1488—14 <u>F1488—14E1</u>	Specification for Coextruded Composite Pipe	IRC®
F1554—15 <u>F1554—2018</u>	Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength	IRC®
F1667—15 <u>F1667—2018</u>	Specification for Driven Fasteners, Nails, Spikes and Staples	IRC®
F1807—15 <u>F1807—2018</u>	Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	IRC®

F1866—13 <u>F1866—2018</u>	Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings	IRC®
F1960—15 <u>F1960—2018</u>	Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing	IRC®
F1973—13E1 <u>F1973—2013(2018)</u>	Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA 11) Fuel Gas Distribution Systems	IRC®
F1986—01(2011) <u>F1986—2001(2011)</u>	Multilayer Pipe Type 2, Compression Joints for Hot and Cold Drinking Water Systems	IRC®
F2080—15 <u>F2080—2016</u>	Specification for Cold-expansion Fittings with Metal Compression-sleeves for Cross-linked Polyethylene (PEX) Pipe	IRC®
F2098—08 <u>F2098—2015</u>	Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings	IRC®
F2159—14 <u>F2159—2018</u>	Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	IRC®
F2389—15 <u>F2389—2017A</u>	Standard for Pressure-rated Polypropylene (PP) Piping Systems	IRC®
F2735—09 <u>F2735—2009(2016)</u>	Standard Specification for Plastic Insert Fittings for SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing	IRC®
F2769—14 <u>F2769—2018</u>	Polyethylene or Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems	IRC®
F2945—2015 <u>F2945—2018</u>	Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing and Fittings	IRC®
AWC	American Wood Council	
Standard Reference Number	Title	Referenced in Code(s):
AWC STJR—2015 <u>STJR—2021</u>	Span Tables for Joists and Rafters	IRC®
ANSI/AWC PWF—2015 <u>PWF—2021</u>	Permanent Wood Foundation Design Specification	IRC®
AWPA	American Wood Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
M4—16 <u>M4—15</u>	Standard for the Care of Preservative-treated Wood Products	IRC®
U1—16 <u>U1—20</u>	USE CATEGORY SYSTEM: User Specification for Treated Wood Except Commodity Specification H	IRC®
AWS	American Welding Society	
Standard Reference Number	Title	Referenced in Code(s):
A5.8M/A5.8—2014 <u>A5.8: 2011—AMD1</u>	Specifications for Filler Metals for Brazing and Braze Welding	IRC®

AWWA	American Water Works Association	
Standard Reference Number	Title	Referenced in Code(s):
C104/A21.4—13 <u>A21.4—16</u>	Cement-mortar Lining for Ductile-iron Pipe and Fittings	IRC®
C151/A21.51—09 <u>A21.51—17</u>	Ductile-iron Pipe, Centrifugally Cast, for Water	IRC®
C504—10 <u>C504—15</u>	Standard for Rubber-seated Butterfly Valves	IRC®
C511—07 <u>C511—17</u>	Reduced-pressure Principle Backflow Prevention Assembly	IRC®
CISPI	Cast Iron Soil Pipe Institute	
Standard Reference Number	Title	Referenced in Code(s):
301—12 <u>301—18</u>	Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications	IRC®
340—12 <u>310—18</u>	Standard Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications	IRC®
CSA	CSA Group	
Standard Reference Number	Title	Referenced in Code(s):
ASME A112.3.4—2013/CSA B45.9—13 <u>B45.9—18</u>	Macerating Toilet Systems and Related Components	IRC®
ASME A112.18.1—2017 <u>A112.18.1—2018/CSA B125.1—2017</u> <u>B125.1—2018</u>	Plumbing Supply Fittings	IRC®
ASME A112.18.2—2015 <u>A112.18.2—2019/CSA B125.2—2015</u> <u>B125.2—2019</u>	Plumbing Waste Fittings	IRC®
A112.18.6—2017 <u>A112.18.6—2021/CSA B125.6—2017</u> <u>B125.6—2021</u>	Flexible Water Connectors	IRC®
ASME A112.19.1—2013 <u>A112.19.1—2018/CSA B45.2—13</u> <u>B45.2—18</u>	Enameled Cast-iron and Enameled Steel Plumbing Fixtures	IRC®
ASME A112.19.2—2013 <u>A112.19.2—2018/CSA B45.1—13</u> <u>B45.1—18</u>	Ceramic Plumbing Fixtures	IRC®
ASME A112.19.3—2008 <u>A112.19.3—2017/CSA B45.4—08 (R2013)</u> <u>B45.4—2017</u>	Stainless Steel Plumbing Fixtures	IRC®
ASSE 4002—2015 <u>1002—2020/ASME A112.1002—2015</u> <u>A112.1002—2020/CSA B125.12—15</u> <u>B125.12—20</u>	Anti-Siphon Fill Valves <u>for water closet tanks</u>	IRC® IRC® IRC®
A112.19.5—2014 <u>A112.19.5—2017/CSA B45.15—2014</u> <u>B45.15—2017</u>	Flush Valves and Spuds for Water-closets, Urinals and Tanks	IRC®
A112.19.7—2017 <u>A112.19.7—2021/CSA B45.10—2017</u> <u>B45.10—2021</u>	Hydromassage Bathtub Systems	IRC® IRC®
ASME A17.1/CSA B44—2016 <u>B44—2019</u>	Safety Code for Elevators and Escalators	IRC®

B64.1.1 —16 B64.1.1 —11(R2016)	Vacuum Breakers, Atmospheric Type (AVB)	IRC®
B64.1.2 —16 B64.1.2 —11(R2016)	Pressure Vacuum Breakers (PVB)	IRC®
B64.1.3 —16 B64.1.3 —11(R2016)	Spill Resistant Pressure Vacuum Breakers (SRPVB)	IRC®
B64.2 —16 B64.2 —11(R2016)	Vacuum Breakers, Hose Connection Type (HCVB)	IRC®
B64.2.1 —16 B64.2.1 —11(R2016)	Hose Connection Vacuum Breakers (HCVB) with Manual Draining Feature	IRC®
B64.2.1.1 —16 B64.2.1.1 —11(R2016)	Hose Connection Dual Check Vacuum Breakers (HCDVB)	IRC®
B64.2.2 —16 B64.2.2 —11(R2016)	Vacuum Breakers, Hose Connection Type (HCVB) with Automatic Draining Feature	IRC®
B64.3 —16 B64.3 —11(R2016)	Dual Check Backflow Preventers with Atmospheric Port (DCAP)	IRC®
B64.4 —16 B64.4 —11(R2016)	Backflow Preventers, Reduced Pressure Principle Type (RP)	IRC®
B64.4.1 —16 B64.4.1 —11(R2016)	Reduced Pressure Principle for Fire Sprinklers (RPF)	IRC®
B64.5 —16 B64.5 —11(R2016)	Double Check Backflow Preventers (DCVA)	IRC®
B64.5.1 —16 B64.5.1 —11(2016)	Double Check Valve Backflow Preventers, Type for Fire Systems (DCVAF)	IRC®
B64.6 —16 B64.6 —11(R2016)	Dual Check Valve Backflow Preventers (DuC)	IRC®
B64.7 —16 B64.7 —11(R2016)	Laboratory Faucet Vacuum Breakers (LFVB)	IRC®
B125.3 —12 B125.3 —18	Plumbing Fittings	IRC®
B137.1 —16 B137.1 —17	Polyethylene (PE) Pipe, Tubing and Fittings for Cold Water Pressure Services	IRC®
B137.2 —16 B137.2 —17	Polyvinylchloride PVC Injection-moulded Gasketed Fittings for Pressure Applications	IRC®
B137.3 —16 B137.3 —17	Rigid Poly (Vinyl Chloride) (PVC) Pipe for Pressure Applications	IRC®
B137.5 —16 B137.5 —17	Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications	IRC®
B137.6 —16 B137.6 —17	Chlorinated polyvinylchloride CPVC Pipe, Tubing and Fittings For Hot- and Cold-water Distribution Systems	IRC®
B137.9 —16 B137.9 —17	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe Systems	IRC®
B137.10 —13 B137.10 —17	Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PE-AL-PE) Composite Pressure Pipe Systems	IRC®
B137.11 —16 B137.11 —17	Polypropylene (PP-R) Pipe and Fittings for Pressure Applications	IRC®
B137.18 —13 B137.18 —17	Polyethylene of Raised Temperature (PE-RT) Tubing Systems for Pressure Applications	IRC®
B181.1 —15 B181.1 —18	Acrylonitrile-butadiene-styrene (ABS) Drain, Waste and Vent Pipe and Pipe Fittings	IRC®
B181.2 —15 B181.2 —18	Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) Drain, Waste and Vent Pipe and Pipe Fittings	IRC®
B181.3 —15 B181.3 —18	Polyolefin and polyvinylidene (PVDF) Laboratory Drainage Systems	IRC®
B182.2 —11 B182.2 —18	PSM Type polyvinylchloride (PVC) Sewer Pipe and Fittings	IRC®

B182.4—15 <u>B182.4—18</u>	Profile polyvinylchloride (PVC) Sewer Pipe & Fittings	IRC®
B182.6—15 <u>B182.6—18</u>	Profile Polyethylene (PE) Sewer Pipe and Fittings for leak-proof Sewer Applications	IRC®
B182.8—15 <u>B182.8—18</u>	Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings	IRC®
B356—10 <u>CAN/CSA-B356—10(R2015)</u>	Water Pressure Reducing Valves for Domestic Water Supply Systems	IRC®
B483.1—07(R2012) <u>B483.1—07(R2017)</u>	Drinking Water Treatment Systems	IRC®
B602—15 <u>B602—16</u>	Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer Pipe	IRC®
C22.2 No. 248.1—M89(R2011) <u>218.1—13(R2017)</u>	Spas, Hot Tubs and Associated Equipment	IRC®
ANSI/CSA/IGSHPA C448 Series—16	Design and Installation of Earth Energy Systems <u>ground source heat pump systems for commercial and residential buildings</u>	IRC®
CSA O325—07 <u>O325—16</u>	Construction Sheathing	IRC®
O437-Series—93 (R2011)	Standards on OSB and Waferboard (Reaffirmed 2006)	IRC®
CAN/CSA/C22.2 No. 60335-2-40—2012 <u>60335-2-40—2017</u>	Safety of Household and Similar Electrical Appliances <u>Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers</u>	IRC®
DASMA	Door & Access Systems Manufacturers Association International	
Standard Reference Number	Title	Referenced in Code(s):
405—2016 <u>105—2017</u>	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors	IRC®
445—2016 <u>115—2017</u>	Standard Method for Testing Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure	IRC®
DOC	United States Department of Commerce	
Standard Reference Number	Title	Referenced in Code(s):
PS 1—091—19	Structural Plywood	IRC®
PS 2—102—18	Performance Standard for Wood-based Structural-use <u>Wood Structural Panels</u>	IRC®
FM	FM Approvals	
Standard Reference Number	Title	Referenced in Code(s):
4880—(2015) <u>ANSI/FM 4880—2017</u>	Approval American National Standard for Class 4 Rating of <u>Evaluating the Fire Performance of Insulated Building Panels or Assemblies and Interior Finish Materials</u>	IRC®
GA	Gypsum Association	
Standard Reference Number	Title	Referenced in Code(s):
GA-253—2016 <u>GA-253—2018</u>	Application of Gypsum Sheathing	IRC®
HVI	Home Ventilating Institute	

Standard Reference Number	Title	Referenced in Code(s):
916—09916—18	Airflow Test Procedure	IRC®
IAPMO	IAPMO Group	
Standard Reference Number	Title	Referenced in Code(s):
CSA B45.5—17/IAPMO Z124—2017 <u>with Errata dated August 2017</u>	Plastic Plumbing Fixtures	IRC®
ICC	International Code Council, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/RESNET/ICC 301—2014 <u>301—2019</u>	Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings <u>Low-rise Dwelling and Sleeping Units</u> using the Energy Rating Index, March 7, 2014, republished 2016	IRC®
ANSI/RESNET/ICC 380—2016 <u>380—2019</u>	Standard for Testing Airtightness of Building Enclosures, <u>Dwelling Unit and Sleeping Unit Enclosures</u> ; Airtightness of Heating and Cooling Air Distribution <u>Systems</u> ; and Airflow of Mechanical Ventilation <u>Systems</u>	IRC®
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry	
Standard Reference Number	Title	Referenced in Code(s):
SP-58—09 <u>SP-58—2018</u>	Pipe Hangers and Supports—Materials, Design, Manufacture, Selection, Application and Installation	IRC®
SP-67—11 <u>SP-67—2017</u>	Butterfly Valves	IRC®
SP-71—2013 <u>SP-71—2018</u>	Gray Iron Swing Check Valves, Flanged and Threaded Ends	IRC®
SP-110—2010a <u>SP-110—2010</u>	Ball Valves, Threaded, Socket Welded, Solder Joint, Grooved and Flared Ends	IRC®
SP-122—2012 <u>SP-122—2017</u>	Plastic Industrial Ball Valves	IRC®
NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
13—1613—19	Standard for Installation of Sprinkler Systems	IRC®
13D—1613D—19	Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes	IRC®
13R—1613R—19	Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies	IRC®
31—1631—20	Standard for the Installation of Oil-burning Equipment	IRC®
58—1758—20	Liquefied Petroleum Gas Code	IRC®
72—1672—19	National Fire Alarm and Signaling Code	IRC®
85—1585—19	Boiler and Combustion Systems Hazards Code	IRC®
241—16211—19	Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances	IRC®

286 — 15286 — 19	Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	IRC®
853 — 15853 — 20	Standard on the Installation of Stationary Fuel Cell Power Systems	IRC®
NFRC	National Fenestration Rating Council, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
400 — 2017100 — 2020	Procedure for Determining Fenestration Products U-Factors	IRC®
200 — 2017200 — 2020	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	IRC®
400 — 2017400 — 2020	Procedure for Determining Fenestration Product Air Leakage	IRC®
NSF	NSF International	
Standard Reference Number	Title	Referenced in Code(s):
14 — 201514 — 2017	Plastics Piping System Components and Related Materials	IRC®
41 — 201141 — 2016	Nonliquid Saturated Treatment Systems (Composting Toilets)	IRC®
42 — 201542 — 2017	Drinking Water Treatment Units—Anesthetic Effects	IRC®
44 — 201544 — 2017	Residential Cation Exchange Water Softeners	IRC®
50 — 201550 — 2017	Equipment for Swimming Pools, Hot Tubs and Other Recreational Water Facilities	IRC®
53 — 201553 — 2017	Drinking Water Treatment Units—Health Effects	IRC®
58 — 201558 — 2017	Reverse Osmosis Drinking Water Treatment Systems	IRC®
61 — 201561 — 2017	Drinking Water System Components—Health Effects	IRC®
350 — 2014350 — 2017a	Onsite Residential and Commercial Water Reuse Treatment Systems	IRC®
358-1 — 2014358-1 — 2017	Polyethylene Pipe and Fittings for Water-based Ground Source “Geothermal” Heat Pump Systems	IRC®
358-2 — 2012358-2 — 2017	Polypropylene Pipe and Fittings for Water-based Ground Source “Geothermal” Heat Pump Systems	IRC®
359 — 2012359 — 2011(R2016)	Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems	IRC®
372 — 2011372 — 2016	Drinking Water Systems Components—Lead Content	IRC®
PCA	Portland Cement Association	
Standard Reference Number	Title	Referenced in Code(s):
400 — 12100 — 2017	Prescriptive Design of Exterior Concrete Walls for One- and Two-family Dwellings (Pub. No. EB241 PCA 100.3)	IRC®
SBCA	Structural Building Components Association	
Standard Reference Number	Title	Referenced in Code(s):

BCSI—2013 (Updated March 2015) BCSI—2018	Building Component Safety Information Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses	IRC®
CFS-BCSI—2008 (updated June 2016)	Cold-formed Steel Building Component Safety Information (CFSBCSI) Guide to Good Practice for Handling, Installing & Bracing of Cold-formed Steel Trusses	IRC®
FS100—12 ANSI/FS100— 12(R2018)	Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies	IRC®
SMACNA	Sheet Metal & Air Conditioning Contractors National Assoc. Inc.	
Standard Reference Number	Title	Referenced in Code(s):
SMACNA—10	Fibrous Glass Duct Construction Standards (2003) 7th edition	IRC®
SMACNA/ANSI—2016	HVAC Duct Construction Standards—Metal and Flexible 4th Edition (ANSI) 2016	IRC®
TPI	Truss Plate Institute	
Standard Reference Number	Title	Referenced in Code(s):
TPI 1—2014	National Design Standard for Metal-plate-connected Metal Plate Connected Wood Truss Construction	IRC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
55A—04 55A—2004	Materials for Built-up Roof Coverings	IRC®
58—96 58—2018	Steel Underground Tanks for Flammable and Combustible Liquids— with Revisions through July 1998 Liquids	IRC®
103—2010	Factory-built Chimneys for Residential Type and Building Heating Appliances—with revisions through July 2012 March 2017	IRC®
127—2011	Factory-built Fireplaces—with revisions through May 2015 July 2016	IRC®
174—04 174—2004	Household Electric Storage Tank Water Heaters—with revisions through April 2015 December 2016	IRC®
180—2012	Liquid-level Indicating Gauges for Oil Burner Fuels and Other Combustible Liquids Liquids—with revisions through May 2017	IRC®
181—05 181—2005	Factory-made Air Ducts and Air Connectors—with revisions through May 2003 April 2017	IRC®
181A—2013	Closure Systems for Use with Rigid Air Ducts and Air Connectors—with revisions through December 1998 March 2017	IRC®
181B—2013	Closure Systems for Use with Flexible Air Ducts and Air Connectors—with revisions through August 2003 March 2017	IRC®
217—06 217—2015	Single and Multiple station Smoke Alarms—with revisions through October 2015 November 2016	IRC®

263—2011	Standards for Fire Test of Building Construction and Materials—with revisions through June 2015 <u>March 2018</u>	IRC®
268—2009 268—2016	Smoke Detectors for Fire Alarm Systems—with revisions through July 2016	IRC®
325—02 325—2017	Door, Drapery, Gate, Louver and Window Operations and Systems—with revisions through May 2015 <u>Systems</u>	IRC®
343—2008 343—2017	Pumps for Oil-burning Appliances—with revisions through June 2013 <u>Appliances</u>	IRC®
378—06	Draft Equipment—with revisions through June 12, 2014 <u>September 2013</u>	IRC®
441—10 441—16	Gas Vents—with revisions through June 12, 2014 <u>July 2016</u>	IRC®
507—99 507—2017	Standard for Electric Fans—with revisions through August 2018	IRC®
508—99 508—2018	Industrial Control Equipment—with revisions through October 2013 <u>Equipment</u>	IRC®
536—97 536—2014	Flexible Metallic Hose—with revisions through December 2014 <u>Hose</u>	IRC®
641—2010	Type L, Low-temperature Venting Systems—with revisions through June 2013 <u>April 2018</u>	IRC®
651—2011	Schedule 40, Type EB and Schedule 80 A Rigid PVC Conduit and Fittings—with revisions through May 2014 <u>June 2016</u>	IRC®
705—04 705—2017	Standard for Power Ventilators—with revisions through December 2013 <u>October 2018</u>	IRC®
723—08 723—2018	Standard for Test for Surface Burning Characteristics of Building Materials—with revisions through August 2013 <u>Materials</u>	IRC®
727—06 727—2018	Oil-fired Central Furnaces—with revisions through October 2013 <u>Furnaces</u>	IRC®
729—03 729—2003	Oil-fired Floor Furnaces—with revisions through October 2013 <u>November 2016</u>	IRC®
730—03	Oil-fired Wall Furnaces—with revisions through October 2013 <u>November 2016</u>	IRC®
732—95 732—2018	Oil-fired Storage Tank Water Heaters—with revisions through October 2013 <u>August 2018</u>	IRC®
737—2011	Fireplaces Stoves—with revisions through August 2015 <u>Stoves</u>	IRC®
790—04	Standard Test Methods for Fire Tests of Roof Coverings—with revisions through July 2014 <u>October 2018</u>	IRC®
795—2011 795—2016	Commercial-industrial Gas Heating Equipment—with revisions through November 2013 <u>Equipment</u>	IRC®
834—04 834—2004	Heating, Water Supply and Power Boilers—Electric—with revisions through December 2013 <u>September 2018</u>	IRC®
842—07 842—2015	Valves for Flammable Fluids—with revisions through May 2015	IRC®
858—05 858—2014	Household Electric Ranges—with revisions through June 2015 <u>2018</u>	IRC®

875—09	Electric Dry-bath Heaters—with revisions through December 2013 September 2017	IRC®
896—93 896—1993	Oil-burning Stoves—with revisions through November 2013 2016	IRC®
923—2013	Microwave Cooking Appliances—with revisions through June 2015 July 2017	IRC®
1026—2012	Electric Household Cooking and Food Serving Appliances—with revisions through August 2015 July 2018	IRC®
1040—96 1040—1996	Fire Test of Insulated Wall Construction—with revisions through October 2012 April 2017	IRC®
1042—2009	Electric Baseboard Heating Equipment—with revisions through September 2014 December 2016	IRC®
1256—02	Fire Test of Roof Deck Construction—with revisions through July 2013 August 2018	IRC®
1261—01 1261—2016	Electric Water Heaters for Pools and Tubs—with revisions through July 2012 September 2017	IRC®
1479—03 1479—2015	Fire Tests of Through-Penetration Firestops—with revisions through June 2015 Firestops	IRC®
1563—2009	Standard for Electric Spas, Hot Tubs <u>Equipment Assemblies</u> , and Associated Equipment—with revisions through March 2015 October 2017	IRC®
1618—09 1618—2015	Wall Protectors, Floor Protectors, and Hearth Extensions—with revisions through October 2015 January 2018	IRC®
1703—02 1703—2002	Flat-plate Photovoltaic Modules and Panels—with revisions through October 2015 September 2018	IRC®
1715—97	Fire Test of Interior Finish Material—with revisions through January 2013 April 2017	IRC®
1738—2010	Venting Systems for Gas-burning Appliances, Categories II, III and IV—with revisions through November 2014 IV	IRC®
1741—2010	Inverters, Converters, Controllers and Interconnection System Equipment with Distributed Energy Resources—with revisions through January 2015 February 2018	IRC®
1777—07	Chimney Liners—with revisions through October 2015 April 2014	IRC®
1897—12 1897—2015	Uplift Tests for Roof Covering Systems —with revisions through September 2015 Systems	IRC®
1995—2011 1995—2015	Heating and Cooling Equipment—with revisions through July 2015 August 2018	IRC®
1996—2009	Electric Duct Heaters—with revisions through June 2014 July 2016	IRC®
2034—08 2034—2017	Standard for Single- and Multiple-station Carbon Monoxide Alarms—with revisions through March 2015 September 2018	IRC®
2075—2013	Standard for Gas and Vapor Detectors and Sensors Sensors—with revisions through December 2017	IRC®
2158A—2010 2158A—2013	Outline of Investigation for Clothes Dryer Transition Duct Duct—with revisions through April 2017	IRC®

2523—092523—2009	Standard for Solid Fuel-fired Hydronic Heating Appliances, Water Heaters and Boilers—with revisions through February 2013 March 2018	IRC®
2703—142703—2014	Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels Panels—with revisions through December 2019	IRC®
9540—149540—2016	Outline of Investigation Standard for Energy Storage Systems and Equipment	IRC®
UL/CSA/ANCE 60335-2-40—2012 201260335-2-40—2019	Standard for Household and Similar Electrical Appliances, Part 2 Appliances- Safety - Part 2-40: Particular Requirements for Motor-compressors Electrical Heat Pumps, Air Conditioners and Dehumidifiers	IRC®
ULC	ULC	
Standard Reference Number	Title	Referenced in Code(s):
CAN/ULC S 402.2—2010 102.2—2018	Standard Methods for Method of Test for Surface Burning Characteristics of Building Materials and Assemblies	IRC®
WDMA	Window and Door Manufacturers Association	
Standard Reference Number	Title	Referenced in Code(s):
I.S. 41— 1311—16	Industry Standard Analytical Method for Design Pressure (DP) Ratings of Fenestration Products	IRC®
WMA	World Millwork Alliance (formerly Association of Millwork Distributors Standards AMD)	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/WMA 400—2016 100—2018	Standard Method of Determining Structural Performance Ratings of Side Hinged Exterior Door Systems and Procedures for Component Substitution	IRC®

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ASCE/SEI	American Society of Civil Engineers	
Standard Reference Number	Title	Referenced in Code(s):
7—16	Minimum Design Loads and Associated Criteria for Buildings and Other Structures with Supplement 1	IEBC®
ASHRAE	ASHRAE	
Standard Reference Number	Title	Referenced in Code(s):
62.1—2016 62.1—2019	Ventilation for Acceptable Indoor Air Quality	IEBC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):

ASME A17.1—2016 <u>A17.1—2019</u> / CSA B44—16 <u>B44—19</u>	Safety Code for Elevators and Escalators	IEBC®
A17.3—2015 <u>A17.3—2020</u>	Safety Code for Existing Elevators and Escalators	IEBC®
A18.1—2014 <u>A18.1—2020</u>	Safety Standard for Platform Lifts and Stairway Chair Lifts	IEBC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
C94/C94M—15 <u>C94M—2017A</u>	Specification for Ready-mixed Concrete	IEBC®
E84—2016 <u>E84—2018B</u>	Standard Test Method for Surface Burning Characteristics of Building Materials	IEBC®
E108—16 <u>E108—2017</u>	Standard Test Methods for Fire Tests of Roof Coverings	IEBC®
E136—16 <u>E136—2016A</u>	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	IEBC®
NFPA	National Fire Protection Agency	
Standard Reference Number	Title	Referenced in Code(s):
NFPA 43R—16 <u>13R—19</u>	Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height	IEBC®
NFPA 72—16 <u>72—19</u>	National Fire Alarm and Signaling Code	IEBC®
NFPA 99—18 <u>99—21</u>	Health Care Facilities Code	IEBC®
NFPA 401—18 <u>101—21</u>	Life Safety Code	IEBC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
723—08 <u>723—2018</u>	Standard for Test for Surface Burning Characteristics of Building Materials— with Revisions through August 2013 <u>Materials</u>	IEBC®
790—04 <u>790—2004</u>	Standard Test Methods for Fire Tests of Roof Coverings— with Revisions through July 2014 <u>October 2018</u>	IEBC®

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Proposed Change as Submitted

ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):
ANSI NGV 5.1—2015 <u>5.1—2016</u>	Residential Fueling Appliances	IFGC®
ANSI FC 1—2012 <u>1—2014</u>	Stationary Fuel Cell Power Systems <u>Fuel cell technologies - Part 3-100: Stationary fuel cell power systems-Safety</u>	IFGC®
LC 1/CSA 6.26—2013 <u>6.26—2016</u>	Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)	IFGC®
Z21.1—2010 <u>Z21.1/CSA 1.1—2016</u>	Household Cooking Gas Appliances	IFGC®

Z21.5.1/CSA 7.1— 20147.1—2017	Gas Clothes Dryers—Volume I—Type 1 Clothes Dryers	IFGC®
Z21.5.2/CSA 7.2— 20147.2—2016	Gas Clothes Dryers—Volume II—Type 2 Clothes Dryers	IFGC®
Z21.8—94 (R2002)(R2012)	Installation of Domestic Gas Conversion Burners	IFGC®
Z21.10.1/CSA 4.1— 20124.1—2017	Gas Water Heaters—Volume I—Storage, Water Heaters with Input Ratings of 75,000 Btu per Hour or Less	IFGC®
Z21.10.3/CSA 4.3— 20114.3—2017	Gas Water Heaters—Volume III—Storage, Water Heaters with Input Ratings above 75,000 Btu per Hour, Circulating and Instantaneous	IFGC®
Z21.11.2— 2011Z21.11.2—2016	Gas-fired Room Heaters—Volume II—Unvented Room Heaters	IFGC®
Z21.13/CSA 4.9— 20114.9—2017	Gas-fired Low-pressure Steam and Hot Water Boilers	IFGC®
Z21.15/CSA 9.1— 20099.1—2009(R2014)	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves	IFGC®
Z21.19/CSA 4.4— 02(R2007)1.4—2014	Refrigerators Using Gas (R1999) Fuel	IFGC®
Z21.24/CSA 6.10— 20066.10—2015	Connectors for Gas Appliances	IFGC®
Z21.40.1/CGA 2.91—1996 (R2011)(R2017)	Gas-fired ₁ Heat Activated Air Conditioning and Heat Pump Appliances	IFGC®
Z21.40.2/CGA 2.92—1996 (R2011)(R2017)	Gas-fired ₁ Work Activated Air Conditioning and Heat Pump Appliances (Internal Combustion)	IFGC®
Z21.42—2014Z21.42— 2013	Gas-fired Illuminating Appliances	IFGC®
Z21.47/CSA 2.3— 20122.3—2016	Gas-fired Central Furnaces	IFGC®
Z21.50/CSA 2.22—2016	Vented <u>Decorative</u> Gas Fireplaces	IFGC®
Z21.54—2009Z21.54— 2014	Gas Hose Connectors for Portable Outdoor Gas-fired Appliances	IFGC®
Z21.58/CSA 4.6— 20131.6—2015	Outdoor Cooking Gas Appliances	IFGC®
Z21.60/CSA 2.26— 20122.26—2017	Decorative Gas Appliances for Installation in Solid-fuel Burning Fireplaces	IFGC®
Z21.61—1983 (R2004)(R2013)	Gas-fired Toilets	IFGC®
Z21.69/CSA 6.16— 20096.16—2015	Connectors for Movable Gas Appliances	IFGC®
Z21.75/CSA 6.27— 20076.27—2016	Connectors for Outdoor Gas Appliances and Manufactured Homes	IFGC®
Z21.80/CSA 6.22— 20116.22—2016	Line Pressure Regulators	IFGC®
Z21.84—2012Z21.84— 2017	Manually Lighted, Natural Gas <u>Decorative Gas Appliances for Installation in Solid-Fuel Solid-Fuel Burning FireplacesAppliances</u>	IFGC®
Z21.86/CSA 2.32— 20082.32—2016	Vented Gas-fired Space Heating Appliances	IFGC®
Z21.91—2007Z21.91— 2017	Ventless Firebox Enclosures for Gas-fired Unvented Decorative Room Heaters	IFGC®
Z21.93/CSA 6.30— 20136.30—2017	Excess Flow Valves for Natural <u>Gas</u> and <u>LP Propane</u> Gas with Pressures up to 5 psig	IFGC®

Z21.97—2012 <u>Z21.97—2014</u>	Outdoor Decorative <u>Gas</u> Appliances	IFGC®
Z83.4/CSA 3.7—2012 <u>Z83.4—2017</u>	Nonrecirculating Direct-gas-fired Industrial Air Heaters <u>Heating and Forced Ventilation Appliances for Commercial and Industrial Application</u>	IFGC®
Z83.8/CSA 2.6—2009 <u>Z83.8—2016</u>	Gas Unit Heater, Gas Packaged Heater <u>Heaters</u> , Gas Utility Heaters, and Gas-fired Duct Furnaces	IFGC®
Z83.11/CSA 4.8—2013 <u>Z83.11—2016</u>	Gas Food Service Equipment	IFGC®
Z83.18—2012 <u>Z83.18—2017</u>	Recirculating Direct Gas-fired Industrial Air Heaters <u>Heating and Forced Ventilation Appliances for Commercial and Industrial Applications</u>	IFGC®
Z83.19—2001(R2009) <u>Z83.19—09(R2014)</u>	Gas-fired High-intensity Infrared Heaters	IFGC®
Z83.20—2008 <u>Z83.20—2016</u>	Gas-fired <u>Tubular and</u> Low-intensity Infrared Heaters	IFGC®
ANSI A13.1—2015 <u>A13.1—2020</u>	Scheme for the Identification of Piping Systems	IFGC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
B16.1—2010 <u>B16.1—2020</u>	Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250	IFGC®
B1.20.1—2013 <u>B1.20.1—2019</u>	Pipe Threads, General Purpose (inch)	IFGC®
B16.5—2015 <u>B16.5—2019</u>	Pipe Flanges and Flanged Fittings: NPS 1/2 through NFPS 24 Metric/Inch Standard	IFGC®
B16.24—2016 <u>B16.24—2021</u>	Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500	IFGC®
B16.42—2016 <u>B16.42—2021</u>	Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300	IFGC®
B16.47—2016 <u>B16.47—2020</u>	Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard	IFGC®
B16.33—2012 <u>B16.33—2012(2017)</u>	Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes 1/2 through 2)	IFGC®
B16.44—2012 <u>B16.44—2012(R2017)</u>	Manually Operated Metallic Gas Valves for Use in Aboveground Piping Systems up to 5 psi	IFGC®
B31.3—2016 <u>B31.3—2020</u>	Process Piping	IFGC®
B31.12—2014 <u>B31.12—2019</u>	Hydrogen Piping and Pipelines	IFGC®
B36.10M—(R2015) <u>B36.10M—2018</u>	Welded and Seamless Wrought-steel Pipe	IFGC®
BPVC—2015 <u>BPVC—2019</u>	ASME Boiler & Pressure Vessel Code (2007 Edition)	IFGC®
CSD-1—2016 <u>CSD-1—2021</u>	Controls and Safety Devices for Automatically Fired Boilers	IFGC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A53/A53M—12 <u>A53M—2018</u>	Specification for Pipe, Steel, Black and Hot Dipped Zinc-coated Welded and Seamless	IFGC®

A106/A106M— 14A106M—2018	Specification for Seamless Carbon Steel Pipe for High-temperature Service	IFGC®
A254—12A254— 2010(2018)	Specification for Copper Brazed Steel Tubing	IFGC®
A268—10A268/A268— 2010(16)	Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service	IFGC®
A269—15A269/A269M— 2015A	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service	IFGC®
A312—15A312/A312M— 2018	Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes	IFGC®
B88—14B88—2016	Specification for Seamless Copper Water Tube	IFGC®
B241/B241M— 12e1B241M—2016	Specification for Aluminum and Aluminum-alloy, Seamless Pipe and Seamless Extruded Tube	IFGC®
B280—13B280—2018	Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service	IFGC®
C315—07(2011)C315— 2007(2016)	Specification for Clay Flue Liners and Chimney Pots	IFGC®
D2513—14e1D2513— 2018A	Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings	IFGC®
E136—16E136—2016A	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	IFGC®
F1973—13e1F1973— 2013(2018)	Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems	IFGC®
F2945—15F2945—2018	Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing and Fittings	IFGC®
CGA	Compressed Gas Association	
Standard Reference Number	Title	Referenced in Code(s):
S-1.1—(2017)S-1.1— (2011)	Pressure Relief Device Standards—Part 1—Cylinders for Compressed Gases	IFGC®
S-1.3—(2016)S-1.3— (2008)	Pressure Relief Device Standards—Part 3—Stationary Storage Containers for Compressed Gases	IFGC®
CSA	CSA Group	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/CSA NGV 5.1— 20155.1—2016	Residential Fueling Appliances	IFGC®
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry	
Standard Reference Number	Title	Referenced in Code(s):
ANSI SP 58—200958— 2018	Pipe Hangers and Supports—Materials, Design and Manufacture	IFGC®
NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
2—162—19	Hydrogen Technologies Code	IFGC®
30A—1830A—21	Code for Motor Fuel Dispensing Facilities and Repair Garages	IFGC®
58—17	Liquefied Petroleum Gas Code	IFGC®

82 —1482—19	Incinerators, Waste and Linen Handling Systems and Equipment	IFGC®
85 —1585—19	Boiler and Combustion Systems Hazards Code	IFGC®
88A —1588A—19	Standard for Parking Structures	IFGC®
211 —16211—19	Standard for the Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	IFGC®
853 —15853—20	Standard Installation of Stationary Fuel Cell Power Systems	IFGC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
103—2010	Factory-built Chimneys, Residential Type and Building Heating Appliances— with Revisions through July 2012 March 2017	IFGC®
127—2011	Factory-built Fireplaces—with Revisions through May 2015 July 2016	IFGC®
378—2006	Draft Equipment Equipment—with revisions through September 2013	IFGC®
441 —2010441—2016	Gas Vents—with Revisions through June 2014 July 2016	IFGC®
641—2010	Type L Low-temperature Venting Systems—with Revisions through June 2013 April 2018	IFGC®
651—2011	Schedule 40, 80, Type EB and 80 A Rigid PVC Conduit and Fittings—with Revisions through May 2014 June 2016	IFGC®
795 —2011795—2016	Commercial-industrial Commercial-Industrial Gas Heating Equipment — with Revisions through November 2013 Equipment	IFGC®
4618 —091618—2015	Wall Protectors, Floor Protectors and Hearth Extensions—with Revisions through October 2015 January 2018	IFGC®
1738—2010	Venting Systems for Gas Burning Appliances, Categories II, III and IV—with Revisions through November 2014 IV	IFGC®
1777—2007	Chimney Liners—with Revisions through October 2015 April 2014	IFGC®
2200—2012	Stationary Engine Generator Assemblies—with Revisions through July October 2015	IFGC®

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Proposed Change as Submitted

ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
ASME A17.1—2016 A17.1—2019/CSA B44—16 B44—19	Safety Code for Elevators and Escalators	IPMC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):

F1346—91 (2010) <u>(2018)</u>	Performance Specifications for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs	IPMC®
NFPA	National Fire Protection Association	
Standard Reference Number	Title	Referenced in Code(s):
40—17 10—21	Standard for Portable Fire Extinguishers	IPMC®
42—15 12—18	Standard on Carbon Dioxide Extinguishing Systems	IPMC®
42A—15 12A—18	Standard on Halon 1301 Fire Extinguishing Systems	IPMC®
47—17 17—20	Standard for Dry Chemical Extinguishing Systems	IPMC®
47A—17 17A—20	Standard for Wet Chemical Extinguishing Systems	IPMC®
25—17 25—20	Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems	IPMC®
72—16 72—19	National Fire Alarm and Signaling Code	IPMC®
80—16 80—19	Standard for Fire Doors and Other Opening Protectives	IPMC®
405—16 105—19	Standard for Smoke Door Assemblies and Other Opening Protectives	IPMC®
204—15 204—18	Standard for Smoke and Heat Venting	IPMC®
750—14 750—19	Standard on Water Mist Fire Protection Systems	IPMC®
2001—15 2001—18	Standard on Clean Agent Fire Extinguishing Systems	IPMC®
UL	Underwriters Laboratories, LLC	
Standard Reference Number	Title	Referenced in Code(s):
268—09 268—2016	Smoke Detectors for Fire Alarm Systems Systems <u>Systems-with revisions through July 2016</u>	IPMC®

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Proposed Change as Submitted

ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A74—15 A74—17	Specification for Cast Iron Soil Pipe and Fittings	IPSDC®
A888—15 A888—18	Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Application	IPSDC®
B88—14 B88—16	Specification for Seamless Copper Water Tube	IPSDC®
B251— 40B251/B251M— 2017	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	IPSDC®
B813—10 B813—2016	Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper-alloy Tube	IPSDC®
B828— 02(2010) B828—2016	Practice for Making Capillary Joints by Soldering of Copper and Copper-alloy Tube and Fittings	IPSDC®
C4—04(2014) C4— 2004(2018)	Specification for Clay Drain Tile and Perforated Clay Drain Tile	IPSDC®
C76—15 C76— 2018A	Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe	IPSDC®

C425— 04(2013)C425— 2004(2018)	Specification for Compression Joints for Vitrified Clay Pipe and Fittings	IPSDC®
C443—12C443— 2012(2017)	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets	IPSDC®
C700—13C700— 2018	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated	IPSDC®
C1173— 10(2014)C1173— 2018	Specification for Flexible Transition Couplings for Underground Piping Systems	IPSDC®
C1277—15C1277— 2018	Specification for Shielding Coupling Joining Hubless Cast-iron Pipe and Fittings	IPSDC®
C1440— 08(2013)C1440— 2017	Specification for Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems	IPSDC®
C1460— 2012C1460—2017	Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground	IPSDC®
C1461— 08(2013)C1461— 2008(2017)	Specification for Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV) Sewer, Sanitary and Storm Plumbing Systems for Above and Below Ground Use	IPSDC®
D2235— 04(2011)D2235— 2004(2016)	Specification for Solvent Cement for Acrylonitrile-butadiene-styrene (ABS) Plastic Pipe and Fittings	IPSDC®
D2564—12D2564— 2012(2018)	Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems	IPSDC®
D2657—07D2657— 2007(2015)	Standard Practice for Heat-fusion Joining of Polyolefin Pipe and Fittings	IPSDC®
D2661—14D2661— 14E1	Specification for Acrylonitrile-butadiene-styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings	IPSDC®
D2665—14D2665— 2014	Specification for Poly Vinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings	IPSDC®
D2729—11D2729— 2017	Specification for Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings	IPSDC®
D2855— 96(2010)D2855— 2015	Standard Practice for Making Solvent-cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings	IPSDC®
D3034—14aD3034— 2016	Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings	IPSDC®
F628—12E1F628— 2012E2	Specification for Acrylonitrile-butadiene-styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core	IPSDC®
F656—15F656—2015	Specification for Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings	IPSDC®
F891—10F891—2016	Specification for Coextruded Poly Vinyl Chloride (PVC) Plastic Pipe with a Cellular Core	IPSDC®
F1488—14F1488— 2014E1	Specification for Coextruded Composite Pipe	IPSDC®
F1499—12F1499— 2017	Specification for Coextruded Composite Drain Waste and Vent Pipe (DWV)	IPSDC®
CISPI	Cast Iron Soil Pipe Institute	
Standard Reference Number	Title	Referenced in Code(s):

301 — 12301 —18	Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications	IPSDC®
340 — 12310 —18	Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications	IPSDC®
CSA	CSA Group	
Standard Reference Number	Title	Referenced in Code(s):
B137.3 — 16B137.3 —17	Rigid Poly Vinyl Chloride (PVC) Pipe for Pressure Applications	IPSDC®
B181.1 — 15B181.1 —18	Acrylonitrile-butadiene-styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings	IPSDC®
B181.2 — 15B181.2 —18	(PVC) Polyvinylchloride and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings	IPSDC®
B182.1 — 14B182.1 —18	Plastic Drain and Sewer Pipe and Pipe Fittings	IPSDC®
B182.2 — 14B182.2 —18	(PVC) Polyvinylchloride Sewer Pipe and Fittings PSM Type	IPSDC®
B182.4 — 15B182.4 —18	Profile PVC Sewer Pipe and Fittings	IPSDC®
B602 — 15B602 —16	Mechanical Couplings for Drain, Waste, and Vent Pipe and Sewer Pipe	IPSDC®
NSF	NSF International	
Standard Reference Number	Title	Referenced in Code(s):
40 — 201340 —2018	Residential Wastewater Treatment Systems	IPSDC®
44 — 201441 —2016	Nonliquid Saturated Treatment Systems (Composing Toilets)	IPSDC®

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Proposed Change as Submitted

AHRI	Air Conditioning, Heating & Refrigeration Institute	
Standard Reference Number	Title	Referenced in Code(s):
1160 (I-P)—2014	Performance Rating of Heat Pump Pool Heaters (<u>with Addendum 1</u>)	ISPSC®
ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):
A108/A118/A136.1 — 2008A136.1 —2019	Specifications for Installation of Ceramic Tile	ISPSC®
APSP	The Association of Pool & Spa Professionals	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/APSP/ICC 4—124 —2019	American National Standard for Aboveground/Onground Residential Swimming Pools—Includes Addenda A Approved April 4, 2013	ISPSC®
ANSI/APSP/ICC 7—137 —2020	American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins	ISPSC®

ANSI/APSP/ICC 14—2014 14—2019	American National Standard for Portable Electric Spa Energy Efficiency	ISPSC®
ANSI/APSP/ICC 15a—2011	American National Standard for Energy Efficiency Residential Inground Swimming Pool and Spas—Includes Addenda A Approved January 9, 2013 Spa Energy Efficiency	ISPSC®
ANSI/APSP/ICC 16—4416—2017	American National Standard for Suction <u>Outlet</u> Fittings (SOFA) for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs	ISPSC®
ASCE/SEI	American Society of Civil Engineers Structural Engineering Institute	
Standard Reference Number	Title	Referenced in Code(s):
ASCE 24—14 24—20	Flood Resistant Design & Construction	ISPSC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
A112.1.2—2012 A112.1.2—2012 (R2022)	Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-connected Receptors)	ISPSC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
A182—15 A182/A182M—2018A	Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-temperature Service	ISPSC®
A240/A240M—45a A240M—17	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications	ISPSC®
A312/A312M—45a A312M—2018	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes	ISPSC®
A403—15 A403/A403M—2018A	Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings	ISPSC®
B88—14 B88—2016	Standard Specification for Seamless Copper Water Tube	ISPSC®
D1785—15 D1785—15E1	Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120	ISPSC®
D2466—15 D2466—2017	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40	ISPSC®
D2846/D2846M—44 D2846M—2017BE1	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems	ISPSC®
F438—15 F438—2017	Standard Specification for Socket-type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40	ISPSC®
F1346—91 (2010) F1346—1991 (2018)	Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs	ISPSC®
CSA	CSA Group	
Standard Reference Number	Title	Referenced in Code(s):
B137.2—16 B137.2—17	Polyvinylchloride (PVC) Injection-moulded Gasketed Fittings for Pressure Application	ISPSC®
B137.3—16 B137.3—17	Rigid Polyvinylchloride (PVC) Pipe and Fitting and Pressure Applications	ISPSC®

B137.6—16 <u>B137.6—17</u>	Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fitting for Hot- and Cold-water Distribution Systems	ISPSC®
C22.2 No. 248.1—13 <u>218.1—13(R2017)</u>	Spas, Hot Tubs and Associated Equipment	ISPSC®
NSF	NSF International	
Standard Reference Number	Title	Referenced in Code(s):
NSF 44—2015 <u>14—2017</u>	Plastics Pumping Systems Components and Related Materials	ISPSC®
NSF 50—2015 <u>50—2017</u>	Equipment and Chemicals for Swimming Pools, Spas, Hot Tubs, and Other Recreational Water Facilities	ISPSC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
1004-1—12	Standard for Rotating Electrical Machines General Requirements—with revisions through June 2014 <u>August 2018</u>	ISPSC®
1081—2008 <u>1081—2016</u>	Standard for Swimming Pool Pumps, Filters and Chlorinators—with revisions through March 2014 <u>October 2017</u>	ISPSC®
1261—2001 <u>1261—2016</u>	Standard for Electric Water Heaters for Pools and Tubs—with revisions through July 2012 <u>September 2017</u>	ISPSC®
1563—2009	Standard for Electric Hot Tubs, Spas <u>Electric Spas Equipment Assemblies</u> , and Associated Equipment—with revisions through March 2015 <u>October 2017</u>	ISPSC®
1995—2011 <u>1995—2015</u>	Heating and Cooling Equipment—with revisions through July 2015 <u>August 2018</u>	ISPSC®
2017—2008	General-purpose Signaling Devices and Systems—with revisions through May 2011 <u>January 2016</u>	ISPSC®

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Proposed Change as Submitted

ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
D2898—10 <u>D2898—2010(2017)</u>	Standard Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing	IWUIC®
D6662—13 <u>D6662—2017</u>	Standard Specification for Polyolefin-based Plastic Lumber Decking Boards	IWUIC®
D7032—14 <u>D7032—2017</u>	Standard Specification for Establishing Performance Ratings for Wood-plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)	IWUIC®
E84—2016 <u>E84—2018B</u>	Standard Test Method for Surface-Burning Characteristics of Building Materials	IWUIC®
E108—16 <u>E108—2017</u>	Standard Test Methods for Fire Tests of Roof Coverings	IWUIC®
E119—2016 <u>E119—2018B</u>	Standard Test Methods for Fire Tests of Building Construction and Materials	IWUIC®
E136—16 <u>E136—2016A</u>	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	IWUIC®

E2768—2014 E2768—2011 <u>(2018)</u>	Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 Minute Tunnel Test)	IWUIC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
263—2011	Standard for Fire Test of Building Construction and Materials—with Revisions through June 2015 <u>March 2018</u>	IWUIC®
723—2008 723—2018	Standard for Test for Surface Burning Characteristics of Building Materials—with Revisions through August 2013 <u>Materials</u>	IWUIC®
790—2004	Standard Test Methods for Fire Tests of Roof Coverings— with Revisions through July 2014 <u>October 2018</u>	IWUIC®

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Proposed Change as Submitted

AHAM	Association of Home Appliance Manufacturers	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/AHAM RAC-1—2008 RAC-1—2015	Room Air Conditioners	IECC®
AHRI	Air-Conditioning, Heating, & Refrigeration Institute	
Standard Reference Number	Title	Referenced in Code(s):
210/240—2016 240—2017	Performance Rating of Unitary Air-conditioning and Air-source Heat Pump Equipment	IECC®
310/380—2014 (CSA-C744-04) 380—2017 (CSA-C744-17)	Standard for Packaged Terminal Air Conditioners and Heat Pumps	IECC®
390 (I-P)—2015 (I-P)—2003	Performance Rating of Single Package Vertical Air-conditioners and Heat Pumps	IECC®
550/590 (I-P)—2015 (I-P)—2018	Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle	IECC®
1160 (I-P) —2014	Performance Rating of Heat Pump Pool Heaters <u>(with Addendum 1)</u>	IECC®
ISO/AHRI/ASHRAE 13256-1 (2017) <u>(2012)</u>	Water-to-Air and Brine-to-Air Heat Pumps—Testing and Rating for Performance	IECC® IECC®
ISO/AHRI/ASHRAE 13256-2 (2017) <u>(2012)</u>	Water-to-Water and Brine-to-Water Heat Pumps — Testing and Rating for Performance	IECC® IECC®
AMCA	Air Movement and Control Association International	
Standard Reference Number	Title	Referenced in Code(s):
205—12 205—19	Energy Efficiency Classification for Fans	IECC®
220—08 (R2012) 220—19	Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating	IECC®
500D—12 500D—18	Laboratory Methods for Testing Dampers for Rating	IECC®
ANSI	American National Standards Institute	
Standard Reference Number	Title	Referenced in Code(s):

<u>Z21.10.3/CSA 4.3—114.3—2017</u>	Gas Water Heaters, Volume III—Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating Tank and Instantaneous	IECC®
<u>Z21.47/CSA 2.3—122.3—2016</u>	Gas-fired Central Furnaces	IECC®
<u>Z83.8/CSA 2.6—092.6—2016</u>	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-fired Duct Furnaces	IECC®
APSP	The Association of Pool & Spa Professionals	
Standard Reference Number	Title	Referenced in Code(s):
<u>44—201414—2019</u>	American National Standard for Portable Electric Spa Energy Efficiency	IECC®
ASHRAE	ASHRAE	
Standard Reference Number	Title	Referenced in Code(s):
<u>ASHRAE 427-2007127-2012</u>	Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners	IECC®
<u>ANSI/ASHRAE/ACCA Standard 183—2007 (RA2014)183—(RA2017)</u>	Peak Cooling and Heating Load Calculations in Buildings, Except Low-rise Residential Buildings	IECC®
<u>ASHRAE—2016ASHRAE—2020</u>	ASHRAE HVAC Systems and Equipment HandbookHandbook-2020	IECC®
<u>ISO/AHRI/ASHRAE 13256-1 (2017)(2012)</u>	Water-to-Air and Brine-to-Air Heat Pumps—Testing and Rating for Performance	IECC® IECC®
<u>ISO/AHRI/ASHRAE 13256-2 (2017)(2012)</u>	Water-to-Water and Brine-to-Water Heat Pumps—Testing and Rating for Performance	IECC® IECC®
<u>55—201355—2017</u>	Thermal Environmental Conditions for Human Occupancy	IECC®
<u>90.1—201690.1—2019</u>	Energy Standard for Buildings Except Low-rise Residential Buildings	IECC®
ASME	American Society of Mechanical Engineers	
Standard Reference Number	Title	Referenced in Code(s):
<u>ASME A17.1—2016A17.1—2019/CSA B44—16B44—19</u>	Safety Code for Elevators and Escalators	IECC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
<u>C90—14C90—2016A</u>	Specification for Load-bearing Concrete Masonry Units	IECC®
<u>C1549—09(2014)C1549—2016</u>	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	IECC®
<u>E283—04(2012)E283—2004(2012)</u>	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	IECC® IECC®
<u>E779—10E779—10(2018)</u>	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	IECC® IECC®
<u>E903—12E903—2012</u>	Standard Test Method Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)	IECC®
<u>E1827—11E1827—2011(2017)</u>	Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door	IECC® IECC®

E1918—06(2015) <u>E1918—2016</u>	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field	IECC®
E2357—11 <u>E2357—2018</u>	Standard Test Method for Determining Air Leakage of Air Barriers Assemblies	IECC®
CRRC	Cool Roof Rating Council	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/CRRC-S100—2016 <u>CRRC-S100 (2020)</u>	Standard Test Methods for Determining Radiative Properties of Materials	IECC®
CTI	Cooling Technology Institute	
Standard Reference Number	Title	Referenced in Code(s):
STD-201—11 <u>STD-201RS(17)</u>	Standard for Certification of Water Cooling Towers Thermal Performances	IECC®
DASMA	Door & Access Systems Manufacturers Association, International	
Standard Reference Number	Title	Referenced in Code(s):
405—2016 <u>105—2017</u>	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors	IECC® IECC®
IES	Illuminating Engineering Society	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ASHRAE/IESNA 90.1—2016 <u>90.1—2019</u>	Energy Standard for Buildings, Except Low-rise Residential Buildings	IECC®
ISO	International Organization for Standardization	
Standard Reference Number	Title	Referenced in Code(s):
ISO/AHRI/ASHRAE 13256-1(2017) <u>13256-1(2012)</u>	Water-to-Air and Brine-to-Air Heat Pumps -Testing and Rating for Performance	IECC®
ISO/AHRI/ASHRAE 13256-2(2017) <u>13256-2(2012)</u>	Water-to-Water and Brine-to-Water Heat Pumps - Testing and Rating for Performance	IECC®
NEMA	National Electrical Manufacturers Association	
Standard Reference Number	Title	Referenced in Code(s):
MG1—2014 <u>MG1—2016</u>	Motors and Generators	IECC®
NFRC	National Fenestration Rating Council, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
400—2017 <u>100—2020</u>	Procedure for Determining Fenestration Products U-factors	IECC® IECC®
200—2017 <u>200—2020</u>	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	IECC® IECC®
400—2017 <u>400—2020</u>	Procedure for Determining Fenestration Product Air Leakage	IECC® IECC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
710—12	Exhaust Hoods for Commercial Cooking Equipment—with Revisions through November 2013 <u>June 2018</u>	IECC®

727 — 06727 —2018	Oil-fired Central Furnaces— with Revisions through October 2013 Furnaces	IECC®
731 — 95731 —2018	Oil-fired Unit Heaters— with Revisions through October 2013 Heaters	IECC®
1784 — 011784 —2015	Air Leakage Tests of Door Assemblies— with Revisions through February 2015 Assemblies	IECC®

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Proposed Change as Submitted

ACCA	Air Conditioning Contractors of America	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/ACCA 2 Manual J—16	Residential Load Calculation Eighth Edition	IECC®
ANSI/ACCA 3 Manual S—14	Residential Equipment Selection	IECC®
APSP	The Association of Pool & Spa Professionals	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/APSP/ICC 14 —201414—2019	American National Standard for Portable Electric Spa Energy Efficiency	IECC® IECC®
ANSI/APSP/ICC 15a —201415—2020	American National Standard for Residential Swimming Pool and Spa Energy Efficiency— includes Addenda A Approved January 9, 2013 Efficiency	IECC® IECC®
ASHRAE	ASHRAE	
Standard Reference Number	Title	Referenced in Code(s):
ASHRAE —2017ASHRAE—2021	ASHRAE Handbook of Fundamentals	IECC®
ASTM	ASTM International	
Standard Reference Number	Title	Referenced in Code(s):
E283 —04(2012)E283—2004(2012)	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	IECC® IECC®
E779 —10E779—2010(2018)	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	IECC® IECC®
E1827 —11E1827—2011(2017)	Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door	IECC® IECC®
DASMA	Door & Access Systems Manufacturers Association	
Standard Reference Number	Title	Referenced in Code(s):
105 —2016105—2017	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors	IECC® IECC®
HVI	Home Ventilating Institute	
Standard Reference Number	Title	Referenced in Code(s):
916 —09916—18	Airflow Test Procedure	IECC®
NFRC	National Fenestration Rating Council, Inc.	

Standard Reference Number	Title	Referenced in Code(s):
400—2017 <u>100—2020</u>	Procedure for Determining Fenestration Products U-factors	IECC® IECC®
200—2017 <u>200—2020</u>	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	IECC® IECC®
400—2017 <u>400—2020</u>	Procedure for Determining Fenestration Product Air Leakage	IECC® IECC®
RESNET	Residential Energy Services Network, Inc.	
Standard Reference Number	Title	Referenced in Code(s):
ANSI/RESNET/ICC 301—2014 <u>301—2019</u>	Standard for the Calculation and Labeling of the Energy Performance of Low-rise Residential Buildings <u>Dwelling and Sleeping Units</u> using an Energy Rating Index First Published March 7, 2014—Republished January 2016	IECC® IECC®
ANSI/RESNET/ICC 380—2016 <u>380—2019</u>	Standard for Testing Airtightness for Building Enclosures, of Building, Dwelling Unit and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems—Republished January 2016 <u>Systems</u>	IECC® IECC®
UL	UL LLC	
Standard Reference Number	Title	Referenced in Code(s):
127—11 <u>127—2011</u>	Standard for Factory Built Fireplaces—with Revisions through May 2015 <u>Factory-built Fireplaces—with revisions through July 2016</u>	IECC®
515—11 <u>515—2015</u>	Electrical Resistance Heat Tracing for Commercial and Industrial Applications Including Revisions through July 2015	IECC®

Reason:

THIS IS THE ADMIN STANDARDS UPDATE CODE CHANGE.

The CP28 Code Development Policy, Section 4.6 requires the updating of referenced standards to be accomplished administratively, and be processed as a Code Change Proposal for consideration by the Administrative Code Change Committee. In September 2018, a letter was sent to each developer of standards that is referenced in the International Codes, asking them to provide ICC with a list of their standards in order to update to the current edition. Listed are the referenced standards that are to be updated based upon responses received from standards developers.

Cost Impact:

The code change proposal will not increase or decrease the cost of construction
Not applicable.

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Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

This proposal also includes unpublished errata:

PCI Precast Prestressed Concrete Institute

PCI 124—18 Design Specification for Fire Resistance of Precast / Prestressed Concrete

Committee Action:

As Modified

AISI

AISI S100—16 w/S1-18 & w/S2-20 (2020) : North American Specification for the Design of Cold-formed Steel Structural Members, 2016, with Supplements 1 -18 and 2-20 (Reaffirmed 2020), dated 2018

AISI S230—18 19 : Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, 2018 2019

ASCE/SEI

847 20 : Standard Specification for the Design of Cold-formed Stainless Steel Structural Members

IIAR

ANSI/IIAR-2—2014, including Addendum A: Safe Design of Closed-Circuit circuit-Ammonia Refrigeration Refrigerating Systems

ANSI/IIAR 4—2015 2020: Installation of Closed-Circuit circuit-Ammonia Refrigeration Mechanical Refrigerating Systems

ANSI/IIAR 5—2013 2019: Startup Start-up of Closed- Circuit circuit-Ammonia Refrigeration Systems

ANSI/IIAR-7—2018 2019 : Developing Operating Procedures for Closed-Circuit circuit-Ammonia Refrigeration Mechanical Refrigerating Systems

ANSI/IIAR-8—2019 2020 : Decommissioning of Closed-Circuit circuit-Ammonia Refrigeration Refrigerating Systems

SJI

SJI 100 45 20 : 44th 45th Edition Standard Specification Load Tables and Weight Tables for Steel Joists and Joist Girders K-Series, LH-Series, DHL-Series, Joist Girders

Committee Reason: The committee stated that the reason for the approval of the proposal was that updating the reference standards is necessary for the function of the codes. (Vote: 13-0)

Assembly Motion:

None

Individual Consideration Agenda

Public Comment 1:

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com) requests As Modified by Public Comment

Modify as follows:

ASTM

E84—2018B 2019b: Standard Test Methods for Surface Burning Characteristics of Building Materials

Commenter's Reason: The CP28 Code Development Policy, Section 4.6 requires the updating of referenced standards to the codes.

The latest edition of ASTM E84 approved by the committee ASTM E05, and by the ASTM committee on standards, is dated 2019b, and was approved in July 2019.

This change is intended to apply to all ICC codes that reference ASTM E84 and not just the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This simply updates the reference to ASTM E84 to the most current edition, as is traditionally done by ICC with consensus standards.

Public Comment 2:

Proponents: Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com); Joseph Holland, representing Hoover Treated Wood Products (jholland@frtw.com) requests As Submitted

Commenter's Reason: This public comment is in support of the committee action to update ASTM E84 to the 2018B edition.

Recent changes to ASTM E84 have created conflicts with the codes by mandating a test for more than 10 minutes must use ASTM E2768. ASTM 2768 is not a test for testing FRTW but other products as demonstrated by in the IWUIC code.

Building codes have always required testing for FRTW be accomplished using ASTM E84. E84 is a ten-minute test for determining flame spread and smoke development. After the determination of the flame spread and smoke development the test is continued for an additional 20 minutes. The additional 20 minutes are not a part of the E84 but uses the same apparatus to determine two additional requirements, maximum flame front, and significant progressive combustion.

ASTM E2768 while a test of 30 minute duration is not a test for FRTW. The only reference to E2768 in the ICC codes is for a ignition resistance material in the IWUIC. It clearly does not apply to FRTW as it is listed as a complying material

Because FRTW is a wood product, any test for FRTW should have been developed by ASTM D7 the committee on wood. D7 understands how FRTW products should be tested.

Examples referenced in 703

D2898—10: Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing,

D3201/D3201M—13: Test Method for Hygroscopic Properties of Fire-retardant-treated Wood and Wood-based Products

D5664—10: Standard Test Method for Evaluating the Effects of Fire-retardant Treatment and Elevated Temperatures on Strength Properties of Fire-retardant Treated Lumber

D6305—08(2015)e1: Practice for Calculating Bending Strength Design Adjustment Factors for Fire-retardant-treated Plywood Roof Sheathing

D5516—09: Test Method of Evaluating the Flexural Properties of Fire-retardant Treated Softwood Plywood Exposed to Elevated Temperatures

D6841—08: Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-retardant Treated Lumber

Conflicts created by mandating all testing using the E84 apparatus for more than 10 minutes be conducted using E2768.

Section 13.1.2 states the flame front limit is of 10-1/2 feet is "... considered evidence of no significant progressive combustion in this test method." The building code clearly states they are to be considered separately.

Section 13.2 allows the testing and qualification of only one surface, " only surfaces that have been individually tested shall be eligible to be classified and reported as meeting the conditions of classification of this standard. The building code mandates FRTW be pressure impregnated or the fire retardant be incorporated into the product during manufacture. Example: the strands in OSB or the particles in particleboard are treated with the fire retardant prior to assembling as a panel product.

This public comment is for the IBC, IRC, IFC, IMC, IEBC and the IWUIC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Codes and standards discussion

Staff Analysis: This public comment is for the IBC, IRC, IFC, IMC, IEBC and the IWUIC.

Public Comment 3:

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com) requests As Modified by Public Comment

Modify as follows:

ASTM

E136—2016A 2019: Standard Test Method for Assessing Combustibility of Behavior of Materials Using in a Vertical Tube Furnace at 750°C

Commenter's Reason: The CP28 Code Development Policy, Section 4.6 requires the updating of referenced standards to the codes.

The latest edition of ASTM E136, as approved by the committee ASTM E05 and by the ASTM committee on standards, is dated 2019. It changed the title of the standard but the test method was not changed.

This change is intended to apply to all ICC codes that reference ASTM E136 and not just the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is simply a referenced standard update.

Public Comment 4:

Proponents: Jeffrey Shapiro, Lake Travis Fire Rescue, representing Self (jshapiro@lfr.org) requests Disapprove

Commenter's Reason: Requesting disapproval of the 2019 update of NFPA 285: Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components

For the past couple years, I have attempted to get the NFPA 285 committee to consider adjustments to the NFPA 285 test procedure before expanding the scope of the standard to allow application of the standard to wall assemblies on any building. My approach was to fight attempts to expand the use of NFPA 285 to include any wall assembly until changes are made to the standard to address concerns regarding sufficiency of the standard with respect to building geometry and possibly wind driven fires. The development process for NFPA 285 has been very contentious on this issue, with the committee completely reversing course from one meeting to the next, and ultimately, the NFPA Standards Council refused to issue one of the updates and returned the entire document to the technical committee. After that, the committee just repeated previous actions, and got the standard approved. I simply gave up in the NFPA process because it was clear that committee members with proprietary interests in the standard were driving the process, and there was no way to stop that train.

The fire service has very little voice in the NFPA 285 process compared to industry interests, and it has been very difficult to get the committee to give these concerns due consideration, and on this issue, I am representing the perspective of the fire service and a code official. Lacking the ability to get appropriate consideration from the NFPA 285 technical committee, I am asking ICC to delay updating the NFPA 285 reference so that the IBC continues to reference a version of NFPA 285 that has a limited scope.

As discussed at numerous code hearings, issues of building geometry, in particular, such as reentrant corners, are not considered by NFPA 285, and they dramatically effect the intensity of the fire exposure to tested assemblies. Either ICC, NFPA or both need to force a discussion about the test sufficiency, recognizing that other international tests and FM tests for the same assembly types are substantially more stringent than what NFPA 285 calls for.

The fire service is well aware of the effects of wind driven fires and of building geometry when it comes to fire behavior, and we can ill afford the risk of catastrophic high-rise fires involving exterior walls. While it has been claimed that there have been no such documented losses involving NFPA 285 compliant panels on buildings, the lack of a bad fire does not equate to a conclusion that everything is fine. Instead, numerous catastrophic exterior fires that have occurred just happened to occur on buildings with non-compliant walls assemblies. What would have happened if NFPA 285 compliant panels were used? Nobody can say for certain.

The previous NFPA 285 test method, that I'm trying to get back to with this public comment, is scoped to ONLY include non-bearing geometrically flat curtain walls attached to buildings, and I have no issue with the current test method continuing for this application. However, the effectiveness of this test method for assemblies with overhangs and inside corners that can intensify the fire exposure needs to be known before these untested geometric variations should be permitted by NFPA 285 or the IBC. UL's mantra is "know by test." We haven't tested, therefore, we don't know.

Building officials and the fire service would be unwise to accept the risk of catastrophic high-rise fires by knowingly standing by while the NFPA 285 test method is exploited. Without knowing the fire performance consequences of stretching the test method to allow assemblies that are not well represented in the test, we cannot reasonably assure public safety or firefighter safety. We must do a better job of making sure we get this issue right because Grenfell Tower was a wake up call with respect to the consequences of inadequate testing. Do we really want to allow buildings to be built with untested wall configurations only to later learn that we screwed up and created a large pool of dangerous existing buildings? The time to address these concerns is now, before NFPA 285's new scoping is permitted by the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal maintains the current requirements of the 2018 IBC in the 2021 edition. Therefore, no change in the requirement will have no impact on cost.

Public Comment 5:

Proponents: Jeremy Brown, representing NSF International (brown@nsf.org) requests As Modified by Public Comment

Modify as follows:

NSF

~~14--2017~~ 14--2018: Plastics Piping System Components and Related Materials

Commenter's Reason: The code should reference the most recent version of the standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This change will not affect cost.

Public Comment 6:

Proponents: Jeremy Brown, representing NSF International (brown@nsf.org) requests As Modified by Public Comment

Modify as follows:

NSF

~~42--2017~~ 42--2018: Drinking Water Treatment Units—Anesthetic Effects

Commenter's Reason: The code should reference the most recent version of the standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This change will not affect cost.

Public Comment 7:

Proponents: Jeremy Brown, representing NSF International (brown@nsf.org) requests As Modified by Public Comment

Modify as follows:

NSF

~~44--2017~~ 44--2018: Residential Cation Exchange Water Softeners

Commenter's Reason: The code should reference the most recent version of the standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This change will not affect cost.

Public Comment 8:

Proponents: Jeremy Brown, representing NSF International (brown@nsf.org) requests As Modified by Public Comment

Modify as follows:

NSF

~~61--2017~~ 61--2018: Drinking Water System Components—Health Effects

Commenter's Reason: The code should reference the most recent version of the standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction This change will not affect cost.

Public Comment 9:

Proponents: Jeremy Brown, representing NSF International (brown@nsf.org) requests As Modified by Public Comment

Modify as follows:

NSF

~~359--2016~~ 359--2018: Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems

Commenter's Reason: The code should reference the most recent version of the standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction This change will not affect cost.

Public Comment 10:

Proponents: David Bixby, representing Air Conditioning Contractors of America (bixster1953@yahoo.com) requests Disapprove

Commenter's Reason: ACCA opposes the Committee's Action to Approve the updated reference to the 2019 edition of ANCE/ CAN-CSA/UL 60335-2-40, and requests the committee to retain the current reference as found in the 2018 IRC. The 2019 edition of the above standard covers residential equipment for direct systems that use A2L flammable refrigerants. Moreover, previous proposals to add coverage for A2L refrigerants for use in all direct systems for air-conditioning applications were **all rejected** by the membership and technical committees during the 2018 "Group A" code change cycle for the IMC and the IFC. Therefore, allowing the 2019 edition of this standard to appear in the Admin section for the IRC would create confusion in the field since no approval requirements will exist in the 2021 IRC. It would also be in direct conflict with the IMC and IFC. Currently the IRC has no additional restrictions or code provisions to safely install these new flammable refrigerant systems in homes, schools and offices. Until training is created and provided for installers, inspectors and firefighters, the current research at AHRI is completed and analyzed, and ASHRAE completes the residential air-conditioning standard (15.2), it is very premature to allow these systems in the residential marketplace. ACCA requests disapproval of this proposal and an overturn of the committee recommendation.

Cost Impact:

The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No change to code.

Public Comment 11:

Proponents: James Narva, representing National Assoc. of State Fire Marshals (jnarva@narvaassociates.com) requests Disapprove

Commenter's Reason: The National Association of State Fire Marshals is opposed to updating the standard for air conditioners to accommodate flammable refrigerants – UL/CSA/ANCE 60335-2-40 – 2019. We ask that the ICC membership overturn the Administrative Committee and maintain the protections afforded in the current IRC. This is consistent with actions taken by the IMC committee and the membership during the 2021 Group A cycle.

In addition, when A2L refrigerants are introduced to flame, they will ignite, burn completely and produce significant quantities of hydrofluoric acid. This highly corrosive contact poison can penetrate tissue, readily poisoning firefighters and citizens through exposure of skin or eyes, or when inhaled or swallowed.

We believe that while a lot of work has been accomplished to identify and mitigate the risks associated with these products, much work remains before there is solid scientific justification to support this change.

For instance, we have learned that flammable refrigerant detectors aren't durable enough to serve their intended purpose in these systems; they may only last a few months to a few years at best. These systems, many times, are in service for decades. It's likely, as we have learned with battery powered smoke alarms, that homeowners will find ways to circumvent the detection system if they don't perform as intended for the life of the equipment.

Training for the fire service will also take some time. Without this training, which is vitally necessary to inform responding fire fighters of these new risks, which include flammability, combustion byproduct issues, including the previously mentioned HF poisoning, we place first responders in harm's way needlessly.

We believe introducing a product safety standard as a stand-alone document in the code is an ill-conceived idea. Product safety standards of this type need installation criteria, either in the form of code provisions or an installation standard, to complete the regulatory loop. The code requires many products to be listed, then goes on to say how they should be installed and maintained. We understand that such an installation standard is under development, but perilously, it is not yet available. The update of this standard absent the accompanying installation standard further only further escalates the risks imposed on fire fighters.

Industry decided to risk developing the regulations for the use of flammable refrigerants without input from the public safety community. We have offered our expertise to industry and remain committed to working toward a safe solution for the implementation of more environmentally palatable refrigerants. Yet, we are disappointed that the industry has resisted our overtures while attempting to use an administrative update procedure to achieve their goal after being turned down during the normal code development process.

Overturning the committee action will provide the time to develop reasonable installation criteria, identify and repair any flaws in the current standard, and implement training programs for fire fighters.

Cost Impact:

The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Since the public comment maintains the current code language, there is no increase or decrease in cost.

Public Comment 12:

Proponents: Paul Armstrong, representing JCI (paul.armstrong@pacodeservices.com) requests Disapprove

Commenter's Reason: This Public Comment is submitted specifically to ask for the disapproval of the update of UL60335-2-40 to the 2019 edition. The code change update proposal would allow flammable refrigerants to be used in direct HVAC systems installed in residential construction covered by only the International Residential Code. Please note that in all model mechanical codes there is currently a prohibition against the use of such flammable refrigerants in residential construction in direct HVAC systems, so this is a major change. This revision was previously heard during the Group A Code Development Cycle last year in a more comprehensive manner and was disapproved by the code committee and the ICC membership. Also, the 2019 edition of this UL Standard is supposed to have completed its review and ANSI approval process but no ICC technical committee has been given the opportunity to review it in its final form to date. Also, note that this is only proposed for the IRC, a more complete proposal is needed to completely cover all types of projects covered by both the IRC and IMC to eliminate confusion between the two model codes.

While the move to more climate friendly refrigerants is ideal, we also need a complete review considering all aspects of the installation of flammable refrigerants in the IRC. Other Public Comments will address the, to date, known issues in the 2019 edition of the UL standard, other concerns need to be addressed as follows:

1. There is an assumption that highly trained contractors will be installing HVAC systems but the IRC is intended for use by all levels of construction experience. As such, there are no safety measures addressed for people to attempt to do this installation themselves. There isn't even a limitation proposed that would require certified installers.

2. Significant training would be required for both professional and volunteer fire department personnel, building inspectors or even home inspectors in dealing with these systems in both emergency and non-emergency situations. Again, nothing has been proposed either through this code development process or heard of outside of it. Home owners would also need much more than just an owner's guide to be safe.
3. Lastly, no evaluation has been provided on the impacts to both new and existing construction under the IRC for the effects of fires involving HVAC systems using flammable refrigerants. The IRC was developed with the current code limitations in mind and further protection may be required of the structure and/or for safety of the occupants as a result.

Please understand that while this seems as if it is a minor change, it really is a big shift in IRC related construction and should be completely evaluated by all facets of industry, especially emergency responders, to understand its impacts on the bulk of the projects that occur in jurisdictions across the United States. Please disapprove the update to the 2019 edition of UL 60335-2-40 so a more thorough review can be completed next code development cycle.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. However the effect of the original proposal will increase the cost of construction based on the use of the 2019 edition of UL 60335-2-40.

Public Comment 13:

Proponents: James Dominik, representing UL Fire Advisory Board on behalf of Public Safety and Emergency Responders requests Disapprove

Commenter's Reason: Requesting disapproval of the update of UL/CSA/ANCE standard 60335-2-40 to the 2019 edition.

UL created a Fire Services Advisory group to evaluate flammable refrigerants and the standards being created. This group is comprised of:

International Association of Firefighters
 International Association of Fire Chiefs
 National Association of State Fire Marshals
 Fire Department New York City
 Chicago Fire Department
 Boston Fire Department
 Plano Fire Department

This group feels that inclusion of flammable refrigerants in the IRC update is premature and should not be included in the proposed IRC update. This recently was not approved in the update to the UMC code.

Since the public safety/emergency responder community has been involved it is apparent there still is much research that is not complete. Until the planned research can be completed and the code creation process can have involvement from all stakeholders this is premature and potentially putting the public and its emergency responders at increased risk. Industry agrees there has been a failure to involve the public safety/emergency responder community in the creation of these standards at this time.

<https://img1.wsimg.com/blobby/go/253af947-bd2c-4f8b-9959-e817c041d781/downloads/UL%20Fire%20Service%20Position%20Statement%20-%20Flammable.pdf?ver=1566757294047>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment 14:

Proponents: Chris Forth, Johnson Controls, representing Johnson Controls (chris.m.forth@jci.com) requests Disapprove

Commenter's Reason: JCI requests that the committee disapprove the update of UL 60335-2-40 to the 2019 version to allow for the completion of all testing, training and standards updates and for a thorough review to be completed during the code development cycle.

- **Proposed change has a substantive impact.** Although characterized as an administrative update to the UL60335-2-40 2019 edition, this is a substantive change that would allow flammable refrigerants in residential and commercial air conditioning and heat pump systems.
- **Proposed change has been rejected by the membership in the Group A cycle (IMC and IFC hearings).** Both the technical committee and the voting ICC membership rejected the proposed change during the IMC and IFC Group A code development hearings in Richmond, Virginia.
- **Training Not In Place to Support Proposed Change.** The proposed change to allow flammable refrigerants in residential and commercial air conditioning and heat pump systems, where such provisions have never been allowed and where licensing requirements and training does not presently exist, should not be rushed. OEM's such as JCI depend on independent contractors to properly and safely install our equipment. These independent contractors need a uniform, nationwide training curriculum fully developed and executed prior to any new flammable equipment being released to the

market. Given that the training materials for the safe handling, transportation and storage of flammable refrigerants are not complete, as well as the absence of a nationwide licensing system to ensure compliance, dictates that the industry is not ready for such provisions. Given adequate time we feel such issues can be addressed but it will require further stakeholder input and study.

- **Uniform Model Codes Not In Place to Support Proposed Change.** The HVAC industry needs both universal models codes (IMC and UMC) to be in alignment in regards to the allowance of flammable refrigerants to ensure consistent safety standards across the country and avoid interstate border compliance gaps. At this time, the UMC has rejected any proposal to allow flammable refrigerants in residential and commercial air conditioning and heat pump systems.
- **Research Designed to Inform Decision Making Not Complete.** In addition to the training and licensing risk, there are critical safety standards (ASHRAE 15.2) and research testing (AHRI, ASHRAE, etc.) which remain incomplete or have yet to even be started as follows:

AHRI/AHRTI Research Projects

1. 9012: Refrigerant Leak Characterization: Evaluates the impact of A2L flammable refrigerant leaks on concentrations in the spaces to which they are connected. Project currently delayed and not expected to be complete until 2020.
2. 9014: Assess Refrigeration Detector Characteristics for Use in HVACR Equipment. Work underway. Not expected to be completed until early 2020.
3. 9015: Assessment of Refrigerant Leakage Mitigation Effectiveness for Air Conditioning and Refrigeration Equipment. Work not started. Uncertain as to when the project will be completed.

ASHRAE Research Projects

4. RP-1806: Post-Ignition Risk Assessment of Flammable Refrigerants. Work has started but has been suspended. Results not expected until the end of 2020.
5. RP-1808: Evaluation of Mechanical Field Joints. Testing is complete but results have not been reviewed for incorporation into standards.
6. WS-1855: Evaluation of Combustion By-Products for HFO Refrigerants. Testing has not started and is not expected to be complete until ~2020

Standards

7. ASHRAE Standard 15.2P: Safety Standard for Air-conditioning and Heat Pump Systems in Residential Applications. In the proposal stage. Not likely to be complete until ~2021 or later. This standard is critical for contractors and inspectors to understand the specific installation, sizing and safety requirements for residential applications.

The results of this new research testing needs to be evaluated and if deemed appropriate incorporated into the multiple standards (ASHRAE 15 / 15.2 – UL 60335-2-40) as well as into future contractor training materials which presently do not exist. Due to the complexity of the multiple standards which have overlapping and in some cases conflicting requirements, inspectors will also need sufficient time to study and digest the standard in order to provide proper enforcement.

For these reasons, JCI reiterates its request that the committee disapprove the update of UL 60335-2-40 to the 2019 version.

Bibliography: Johnson Controls

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. However the effect of the original proposal would increase the cost of compliance based on the use of the 2019 edition of UL 60335-2-40 which would require the addition of special refrigerant sensors, dedicated control schemes and dedicated piping requirements for specific applications.

Public Comment 15:

Proponents: Joe Holomy, Illinois Fire Advisory Commission, representing Illinois Fire Advisory Commission requests Disapprove

Commenter's Reason: Requesting disapproval of the update of UL/CSA/ANCE standard 60335-2-40 to the 2019 edition.

The Illinois Fire Advisory Commission (FAC) has determined the vast majority of the mainstream refrigerant replacements being proposed by industry are odorless and colorless and have a higher heat ignition resulting in the introduction of a new risk to the general public. The FAC has formally voted on and adopted Resolution 01-19 which is attached.



Resolution 01-19

ILLINOIS FIRE ADVISORY COMMISSION RELATING TO INDUSTRY FLAMMABLE REFRIGERANTS

1. Whereas the Illinois Fire Advisory Commission (FAC) is a statutorily created organization that is charged with advising the Office of the State Fire Marshal in the exercise of its duties which includes fire prevention and life safety subject matter (20 ILCS 2905/3);
2. Whereas the FAC is a fire service member organization that promotes progress of all major fire service organizations as it relates to the life, health, and safety of the citizens of the State of Illinois while also being the common voice on behalf of the fire service members in communicating with the Illinois General Assembly Fire Caucus, with membership including the Associated Firefighters of Illinois, the City of Chicago Fire Department, Illinois Chapter of the International Association of Arson Investigators, Illinois Association of Fire Protection Districts, Illinois Fire Chiefs Association, Illinois Fire Inspectors Association, Illinois Fire Safety Alliance, Illinois Fire Service Institute, Illinois Firefighters Association, Illinois Professional Firefighters Association, Illinois Society of Fire Service Instructors, Mutual Aid Box Alarm System, and the Northern Illinois Alliance of Fire Protection Districts and;
3. Whereas it has come to the attention of the FAC that the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) representing manufacturers of the Heating, Ventilation, Air Condition, Refrigeration and Water Heating equipment (HVAC&R) within the global industry is proposing a change to the International Residential Building Code allowing for a new refrigerant that has been determined to be highly flammable and;
4. Whereas the FAC has further determined the vast majority of the mainstream refrigerant replacements being proposed by industry are odorless and colorless and have a higher heat ignition resulting in the introduction of a new risk to the general public and;
5. Whereas the FAC has discovered until now, the public safety community has not been involved in the testing of these products and policy discussions as to the long-term impacts;

It is hereby Resolved that the FAC:

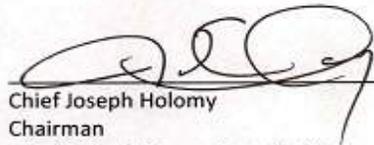
1. Formally objects to the proposed industry action relating to flammable refrigerants as it is currently being introduced;

2. Urges industry representatives to withdraw any current proposals to National Codes and Standards that would result in the widespread installation of equipment using flammable refrigerants;

3. Urges industry representatives to fully research the actual and potential consequences of their proposed action relative to public and firefighter safety prior to implementing such action; and

4. Urges industry representatives to formally meet with the FAC prior to the implementation of any such proposed action for the specific purpose of discussing the proposed industry action and any alternative actions that could be implemented which address public and firefighter safety.

We further certify that the FAC is duly organized and existing, and that the members have voted, authorized, and called for the foregoing resolution.



Chief Joseph Holomy
Chairman
Illinois Fire Advisory Commission

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment 16:

Proponents: Michael O'Brian, Fire and Life Safety Section of the International Association of Fire Chiefs, representing Fire and Life Safety Section of the International Association of Fire Chiefs (mobrian@brightonareafire.com) requests Disapprove

Commenter's Reason: Requesting disapproval of the update of UL/CSA/ANCE standard 60335-2-40 to the 2019 edition.

During the Group A code development process, several proposals to allow air conditioning equipment using increased quantities of flammable refrigerants were discussed at length, and the committee voted against those proposals. Public comments were filed, and the membership considered those same proposals. Those proposals failed again, so the 2021 IMC will not change its current restrictions on flammable refrigerants.

The proposal to administratively update the standard for air conditioning equipment is a "back door" for the industry to achieve what they couldn't during the IMC debates.

Regardless of the process, the flaws in the proposal remain, including:

- Wildland fire potential has not been considered during the development of this standard
- This is a product safety standard; we also need installation criteria for this new risk
- Training for fire fighters so that they are aware of the risks associated with flammable refrigerants is imperative. This would include ignition/fire risks as well as the risks associated with the combustion byproducts of these gases.
- Serious consideration should be given to finding a way to odorize this material.
- The risk mitigation scheme proposed (detection/ventilation) should be validated through a comprehensive study before the standard is used.

As one person said "So, someone wants to run flammable, unodorized gas through your home at high pressure through copper tubing . . . what could go wrong?"

We urge the ICC membership to overturn the committee and keep the current standard until the concerns over flammable refrigerants are addressed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment 17:

Proponents: Matthew Perez, Illinois State Fire Marshal, representing Illinois State Fire Marshal requests Disapprove

Commenter's Reason: UL should curtail development of Standard 60335-2-40 until all pertinent research is available to assure the current level of safety is maintained and resist any proposals to national codes and standards that would result in the widespread installation of equipment using flammable refrigerants. UL should take into consideration the input and expertise of the fire service as well as acquire complete scientific justification in order to fully address risk management..

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment 18:

Proponents: Richard Swan, representing IAFF requests Disapprove

Commenter's Reason: Requesting disapproval of the update of UL/CSA/ANCE standard 60335-2-40 to the 2019 edition.

The International Association of Fire Fighters represents over 317,000 fire fighters and paramedics in the United States and Canada and these are the bulk of the responders that will be facing this issue. There are many issues of concern with the proposal; no definition of the word "mildly flammable", the marketing department came up with this because it is quickly tied to "when compared to hydrocarbons", A2L must only be used in A2L equipment- we all know this won't happen, what are the combustion byproducts of these new refrigerants, questions related to the detection systems and detectors, using non-standard DOA and NFPA symbols, complete lack of knowledge, analysis and consideration as to: Mitigation of incidents involving now flammable appliances - Tactical considerations for homes containing flammable appliances - Identification of this hazard prior to determining the risk vs. reward of committing personnel to an interior attack.

Based upon the amount of research pending, and the apparent lack of knowledge around some of these issues, the development of regulations enabling the use of flammable refrigerants is premature. If done now without careful thought and consideration the consequences could be catastrophic.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment 19:

Proponents: Jim Tidwell, representing Honeywell (jimtidwell@tccfire.com) requests Disapprove

Commenter's Reason: This public comment is for disapproval of the proposed update of UL 60335-2-40. This is a product safety standard that covers air conditioning equipment.

The proposal to update the standard for air conditioning systems to allow for the use of flammable refrigerants is premature and in direct conflict with actions taken by the membership in the Group A cycle (IMC and IFC hearings). This is especially relevant for direct systems where a flammable refrigerant can leak in the occupied space. Whether it's a small commercial system or a residential system, the safety issues are the same. The IMC committee rejected each and every proposal to allow increased quantities of flammable refrigerants and their rejections were upheld by the membership. Now, the proponents would have the membership negate that process through an administrative update of the standard. We don't believe it was ever the intent of the ICC Board of Directors to allow an administrative standard update to circumvent the normal code development process, which will be the result if the standard is allowed to be updated.

In addition to the philosophical issues, we believe the update of this product safety standard is premature for the following reasons:

- A product safety standard such as UL-60335-2-40, even if it is appropriate, is only part of the regulatory solution. In addition to the product safety standard, installation criteria are necessary for the safe installation and use of any equipment - and that criteria doesn't currently exist. At this time, ASHRAE is in the process of developing the installation standard for this equipment in residential occupancies (ASHRAE 15.2). In the current ASHRAE draft, there are requirements for outdoor equipment to be located a minimum distance from a structure; requirements for protection of piping containing flammable refrigerants and other requirements to attempt to address the additional risks involved with the use of flammable refrigerants. These are not included in the UL standard, as it's only addresses product safety, not installation.
- There are several studies (ASHRAE, AHRI, DOE, etc.) in various stages to validate the requirements set by these standards. These studies will likely uncover deficiencies in the standards that will need to be addressed before equipment is actually installed. Note that approximately 8 million air conditioning units are installed in the U.S. each year; getting this right is of paramount importance.
- The UL Standard has not received a review from any ICC technical committee; the Administrative Committee did not debate the technical issues related to the standard, although several members of the ICC attempted to address them. The Administrative Committee chose to move the standard forward based on the fact that the procedural issues were all satisfied.

In addition to these facts, the membership should be aware that the standard has a number of gaps/issues that many believe are critical and need to be corrected including:

- The standard doesn't require risk mitigation unless the equipment exceeds a certain amount of refrigerant; a formula is used to calculate the maximum amount allowed without mitigation rather than a fixed weight or volume of refrigerant. A research project is currently underway by the Oak Ridge National Laboratory to investigate the proper basis for setting charge limits of all flammable refrigerants; when that study is complete, the results should be used to determine the appropriate amount of flammable refrigerant allowed in the equipment.
- Once triggered, the risk mitigation scheme is to detect any leaking refrigerant and activate mechanical air movement (either circulation or ventilation). There is a study proposed by AHRI to evaluate the detection and mitigation strategies in this standard. It hasn't begun as of this writing, and may identify gaps in the standard in need of attention.
- The standard does not require listed detectors; rather, it requires sensors to be "evaluated" with the air conditioning equipment being listed. This is a significant difference. UL staff testified in the Group A hearings that there is a UL listing standard for these devices, so there should be no reason to allow anything other than listed detectors. The requirements in the latest draft of the standard for evaluation of detectors doesn't address calibration drift, which is a known problem with existing detectors that could render them useless.
- In determining the maximum charge size, the standard assumes that any leak will diffuse completely and immediately throughout the room into which it leaks – this is a false assumption; no gas or liquid diffuses immediately and completely in the atmosphere. If the leak is in liquid form, the situation worsens. In tests at UL, leaks of this fluid actually pooled on the floor and off-gassed for some period of time. We don't believe this is addressed in the standard.
- The standard allows unlimited quantities of refrigerant where the system is installed with shutoff valves activated by refrigerant detectors to limit the amount of refrigerant released. Neither the valves nor the detectors are required to be listed. This may be a substantial safety risk, but more research is needed to make that determination.
- Many of the requirements of the standard are based upon complex computer modeling. During actual tests, it was found that turbulence had a significant and dangerous effect on the ignitability and burning characteristics of these refrigerants. Turbulence isn't a condition that can be adequately predicted using computer models.
- The standard only requires detection inside equipment. Any failure of piping that results in leaked refrigerant outside the equipment will not result in detection and mitigation.
- In the current draft of the standard, notification of occupants is by a "series of flashing lights", which will not produce adequate information for occupants to react to a leak.

Overturning the committee for this single standard will allow the industry and public safety officials the opportunity to address these important issues; updating to the new standard presents unnecessary and inordinate risks to our communities. Please vote to overturn the committee.

Here is the link to the AHRI report:

http://www.ahrinet.org/App_Content/ahri/files/RESEARCH/Technical%20Results/AHRI_9007-01_Final_Report.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

EB2-19

IEBC@: [BS] 202

Proposed Change as Submitted

Proponents: Michael Fillion, representing National Council of Structural Engineers Association (mrf.structure@verizon.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Revise as follows:

[BS] SUBSTANTIAL STRUCTURAL ALTERATION. An alteration in which the gravity load-carrying structural elements altered within a 5-year period support more than 30 percent of the total floor and roof area of the building or structure. The areas to be counted toward the 30 percent shall include mezzanines, penthouses, and in-filled courts and shafts tributary to the altered structural elements. For the purpose of this definition, a structural element shall be considered altered if its demand is increased by more than 5% or its capacity is reduced by any amount.

Reason: The National Council of Structural Engineers Existing Buildings Sub-committee has received inquiries from practicing structural engineers regarding the interpretation of this definition. In Massachusetts, a structural engineering firm requested an interpretation from the Chief of Building Inspectors and the Structural Advisory Committee to the Massachusetts State Building Code. From our feedback, practicing structural engineers have various opinions regarding the interpretation of the definition. A common question is "What is considered an alteration." The intent of the proposed added language is to make it clear what an alteration is in the context of the definition.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The intent of this code change proposal is for clarification

EB2-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Item is not required in the code - commentary material (Vote: 12-2)

Assembly Action:

None

EB2-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: [BS]

Proponents:

Michael Fillion, representing National Council of Structural Engineers Association (mrf.structure@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

[BS] SUBSTANTIAL STRUCTURAL ALTERATION. An alteration in which the gravity load-carrying structural elements required to be replaced or altered within a 5-year period support more than 30 percent of the total floor and roof area of the building or structure. The areas to be counted toward the 30 percent shall include mezzanines, penthouses, and in-filled courts and shafts tributary to the altered structural elements. ~~For~~

~~the purpose of this definition, a structural element shall be considered altered if its demand is increased by more than 5% or its capacity is reduced by any amount~~

Commenter's Reason: NCSEA's basis for this code change proposal is based on feedback from practicing structural engineers and code officials who have expressed confusion with the definition. Our feedback has indicated that the definition is being interpreted in more than one way. Depending on which way the definition is interpreted can result in weather or not the lateral load resisting system of an altered building is required to meet the wind and seismic requirements of the IBC.

The word 'altered' is not defined in Definitions in Chapter-2 of the IEBC or IBC. The Webster dictionary defines altered as: 'made different in some way'.

Sections 503.3, 706.2 & 806.2 of the IEBC refer to existing structural elements carrying gravity loads. In those sections, the word altered is used. It states that when an alteration causes an increase in gravity loads of more than 5% or any decrease in capacity to a gravity load-carrying structural element, the element shall be replaced or altered as needed to comply with IBC gravity loads for new structures. In the context of these sections, the replaced or altered elements for IBC compliance count toward the 30% of the total floor and roof area threshold.

Our proposal makes it clear which gravity load-carrying structural elements contribute to the 30% threshold which determines weather or not the lateral load resisting system of a building is required to be IBC compliant for wind and seismic loads.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If the 2018 definition of Substantial Structural Alteration is misinterpreted, it may result in an increase of construction cost.

Public Comment# 1844

EB3-19

IEBC@: 202

Proposed Change as Submitted

Proponents: Allison Cook, Arlington County, VA, representing VBCOA; Kenney Payne, Moseley Architects, representing AIA Virginia (kpayne@moseleyarchitects.com); Ronald Clements Jr, representing Chesterfield County (clementsro@chesterfield.gov); Shaina Abney (shaina.abney@fairfaxcounty.gov); Bob Orr, representing VBCOA (borr@culpepercounty.gov); Charles Vernon, representing VBCOA (cvernon@arlingtonva.us); Michael Williams, representing Virginia Building and Code Officials Association (VBCOA) (mike.williams@harrisonburgva.gov); Debra McMahon (debra.mcmahon@fairfaxcounty.gov); David Collins, The American Institute of Architects, representing The American Institute of Architects (dcollins@preview-group.com); Christina Jackson, City of Norfolk, representing City of Norfolk / WICED of VA (christina.reynolds@norfolk.gov)

2018 International Existing Building Code

Revise as follows:

WORK AREA. ~~That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code. intended room, space, or portion of a building or structure where a wall or walls are added, relocated, or removed. Work area excludes the following:~~

1. The addition or elimination of any door or window.
2. The reconfiguration or extension of any system
3. The installation of any additional equipment
4. the removal of finished flooring or ceiling materials
5. adjacent rooms or other rooms, spaces, or portions of the building or structure where incidental work entailed by the intended work must be performed
6. portions of the building or structure where work not initially intended is specifically required by this code.

Reason: The current definition of work area is too vague and creates the potential for significantly different interpretations of what constitutes a work area. In Virginia, we have experienced inconsistency between jurisdictions and adopted this definition to address that issue. The proposed change provides more details on what is and is not part of a work area. This should help both building officials and design professionals.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal is only to add clarification, it should not impact cost.

EB3-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The revised definition better reflects work area and is presented in a better format. There was some concern that the revised wording of the main portion of the definition reduces the scope of the term too much. (Vote: 8-5)

Assembly Action:

None

EB3-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 202

Proponents:

Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

WORK AREA. That intended room, space, or portion of a building or structure where a wall or walls are added, relocated, or removed. Work area excludes the following:

1. The addition or elimination of any door, ~~or window~~ or skylight.
2. The reconfiguration or extension of any system
3. The installation of any additional equipment
4. the removal of finished flooring or ceiling materials
5. adjacent rooms or other rooms, spaces, or portions of the building or structure where incidental work entailed by the intended work must be performed
6. portions of the building or structure where work not initially intended is specifically required by this code.

Commenter's Reason: The modification proposed by this PC to include skylights in exclusion 1., adds further clarification to what is considered a "work area" and is consistent with the intent of the proposal on the whole. Skylights should be included with doors and windows in exclusion item 1., for the same reasons windows and doors are.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This PC will reduce the cost of construction by ensuring skylight replacement or elimination is not considered part of a work area and exempt from requirements that are not intended for such activity.

Public Comment# 1827

EB5-19

IEBC@: SECTION 508, 508.1, 508.2, 508.3, 508.4, 508.4.1, 508.4.2, 508.5, 508.6, 508.7, 508.8, 508.8.1, 508.8.2, 508.8.3, 508.8.4, 508.8.5, TABLE 508.8.5, 508.8.6, 508.8.7, 508.8.8, 508.8.9, 508.8.10, 508.8.11, 508.8.12, 508.8.13, 508.8.14, 508.8.15, 508.9, 508.9.1, 508.9.2, 508.9.3, 508.9.4, SECTION 405 (New), 405.1 (New), SECTION 705 (New), 705.1 (New), 705.2 (New), 705.3 (New), 705.3.1 (New), 705.3.2 (New), 705.3.3 (New), 705.3.4 (New), TABLE 705.3.4 (New), 705.3.5 (New), 705.3.6 (New), 705.3.7 (New), 705.3.8 (New), 705.3.9 (New), 705.3.10 (New), 705.3.11 (New), 705.3.12 (New), 705.3.13 (New), 705.3.14 (New), 705.3.15 (New), 705.4 (New), SECTION 806 (New), 806.1 (New), 806.2 (New), SECTION 906 (New), 906.1 (New), 906.2 (New), SECTION 1006 (New), 1006.1 (New), SECTION 1105 (New), 1105.1 (New), 1105.2 (New), 1105.3 (New), 1105.4 (New), SECTION 1204 (New), 1204.1 (New), 1204.1.1, 1204.1.2, 1204.1.3, 1204.1.4, 1301.2.6 (New)

Proposed Change as Submitted

Proponents: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com)

2018 International Existing Building Code

Revise as follows:

SECTION 305 508 ACCESSIBILITY FOR EXISTING BUILDINGS

~~305.1~~ **508.1 Scope.** The provisions of Sections ~~305.1-508.1~~ through ~~305.9-508.9~~ apply to maintenance, *change of occupancy*, *additions* and *alterations* to *existing buildings*, including those identified as *historic buildings*.

~~305.2~~ **508.2 Maintenance of facilities.** A *facility* that is constructed or altered to be *accessible* shall be maintained *accessible* during occupancy.

~~305.3~~ **508.3 Extent of application.** An *alteration* of an existing *facility* shall not impose a requirement for greater accessibility than that which would be required for new construction. *Alterations* shall not reduce or have the effect of reducing accessibility of a *facility* or portion of a *facility*.

~~305.4~~ **508.4 Change of occupancy.** *Existing buildings* that undergo a change of group or occupancy shall comply with this section.

Exception: Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in *existing buildings* and facilities undergoing a *change of occupancy* in conjunction with *alterations* where the *work area* is 50 percent or less of the aggregate area of the building.

~~305.4.1~~ **508.4.1 Partial change of occupancy.** Where a portion of the building is changed to a new occupancy classification, any *alterations* shall comply with Sections ~~305.6-508.6~~, ~~305.7-508.7~~ and ~~305.8-508.8~~.

~~305.4.2~~ **508.4.2 Complete change of occupancy.** Where an entire building undergoes a *change of occupancy*, it shall comply with Section ~~305.4-508.4.1~~ and shall have all of the following accessible features:

1. Not fewer than one accessible building entrance.
2. Not fewer than one accessible route from an accessible building entrance to *primary function* areas.
3. Signage complying with Section 1111 of the International Building Code.
4. Accessible parking, where parking is being provided.
5. Not fewer than one accessible passenger loading zone, where loading zones are provided.
6. Not fewer than one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.

Where it is *technically infeasible* to comply with the new construction standards for any of these requirements for a change of group or occupancy, Items 1 through 6 shall conform to the requirements to the maximum extent technically feasible.

Exception: The accessible features listed in Items 1 through 6 are not required for an accessible route to Type B units.

~~305.5~~ **508.5 Additions.** Provisions for new construction shall apply to *additions*. An *addition* that affects the accessibility to, or contains an area of, a *primary function* shall comply with the requirements in Section ~~305.7-508.7~~.

~~305.6~~ **508.6 Alterations.** A *facility* that is altered shall comply with the applicable provisions in Chapter 11 of the International Building Code, unless *technically infeasible*. Where compliance with this section is *technically infeasible*, the *alteration* shall provide access to the maximum extent technically feasible.

Exceptions:

1. The altered element or space is not required to be on an accessible route, unless required by Section ~~305.7-508.7~~.
2. Accessible means of egress required by Chapter 10 of the International Building Code are not required to be provided in existing facilities.

3. The *alteration* to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.
4. Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in *existing buildings* and facilities undergoing *alterations* where the *work area* is 50 percent or less of the aggregate area of the building.

305-7 508.7 Alterations affecting an area containing a primary function. Where an *alteration* affects the accessibility to, or contains an area of *primary function*, the route to the *primary function* area shall be *accessible*. The accessible route to the *primary function* area shall include toilet facilities and drinking fountains serving the area of *primary function*.

Exceptions:

1. The costs of providing the *accessible* route are not required to exceed 20 percent of the costs of the *alterations* affecting the area of *primary function*.
2. This provision does not apply to *alterations* limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to *alterations* limited solely to mechanical systems, electrical systems, installation or *alteration* of fire protection systems and abatement of hazardous materials.
4. This provision does not apply to *alterations* undertaken for the primary purpose of increasing the accessibility of a *facility*.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

305-8 508.8 Scoping for alterations. The provisions of Sections ~~305-8-1~~ 508.8.1 through ~~305-8-15~~ 508.8.15 shall apply to *alterations* to *existing buildings* and *facilities*.

305-8-1 508.8.1 Entrances. Where an *alteration* includes alterations to an entrance that is not accessible, and the *facility* has an *accessible* entrance, the altered entrance is not required to be *accessible* unless required by ~~Section 305-7.~~ Section 508.7. Signs complying with Section 1111 of the International Building Code shall be provided.

305-8-2 508.8.2 Elevators. Altered elements of existing elevators shall comply with ASME A17.1 and ICC A117.1. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

305-8-3 508.8.3 Platform lifts. Platform (wheelchair) lifts complying with ICC A117.1 and installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

305-8-4 508.8.4 Stairways and escalators in existing buildings. Where an escalator or stairway is added where none existed previously and major structural modifications are necessary for installation, an accessible route shall be provided between the levels served by the escalator or stairways in accordance with Section 1104.4 of the International Building Code.

305-8-5 508.8.5 Ramps. Where slopes steeper than allowed by Section 1012.2 of the International Building Code are necessitated by space limitations, the slope of ramps in or providing access to existing facilities shall comply with Table ~~305-8-5-~~ 805.8.5.

**TABLE 305-8.5 508.8.5
RAMPS**

SLOPE	MAXIMUM RISE
Steeper than 1:10 but not steeper than 1:8	3 inches
Steeper than 1:12 but not steeper than 1:10	6 inches

For SI: 1 inch = 25.4 mm.

305-8.6 508.8.6 Accessible dwelling or sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added, the requirements of Section 1107 of the International Building Code for Accessible units apply only to the quantity of spaces being altered or added.

305-8.7 508.8.7 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being altered or added, the requirements of Section 1107 of the International Building Code for Type A units apply only to the quantity of the spaces being altered or added.

305-8.8 508.8.8 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements of Section 1107 of the International Building Code for Type B units apply only to the quantity of the spaces being added. Where Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered and where the *work area* is greater than 50 percent of the aggregate area of the building, the requirements of Section 1107 of the International Building Code for Type B units apply only to the quantity of the spaces being altered.

305-8.9 508.8.9 Jury boxes and witness stands. In *alterations*, accessible wheelchair spaces are not required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where the ramp or lift access restricts or projects into the required means of egress.

305-8.10 508.8.10 Toilet rooms. Where it is *technically infeasible* to alter existing toilet and bathing rooms to be *accessible*, an *accessible* family or assisted-use toilet or bathing room constructed in accordance with Section 1109.2.1 of the International Building Code is permitted. The family or assisted-use toilet or bathing room shall be located on the same floor and in the same area as the existing toilet or bathing rooms. At the inaccessible toilet and bathing rooms, directional signs indicating the location of the nearest family or assisted-use toilet room or bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

305-8.11 508.8.11 Additional toilet and bathing facilities. In assembly and mercantile occupancies, where additional toilet fixtures are added, not fewer than one accessible family or assisted-use toilet room shall be provided where required by Section 1109.2.1 of the International Building Code. In recreational facilities, where additional bathing rooms are being added, not fewer than one family or assisted-use bathing room shall be provided where required by Section 1109.2.1 of the International Building Code.

305-8.12 508.8.12 Dressing, fitting and locker rooms. Where it is *technically infeasible* to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level shall be provided. Where separate-sex facilities are provided, accessible rooms for each sex shall be provided. Separate-sex facilities are not required where only unisex rooms are provided.

305-8.13 508.8.13 Fuel dispensers. Operable parts of replacement fuel dispensers shall be permitted to be 54 inches (1370 mm) maximum, measuring from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

305-8.14 508.8.14 Thresholds. The maximum height of thresholds at doorways shall be $\frac{3}{4}$ inch (19.1 mm). Such thresholds shall have beveled edges on each side.

305-8.15 508.8.15 Amusement rides. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with requirements for new construction in Section 1110.4.8 of the International Building Code.

305-9 508.9 Historic buildings. These provisions shall apply to *facilities* designated as historic structures that undergo *alterations* or a *change of occupancy*, unless *technically infeasible*. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the *facility*, as determined by the authority having jurisdiction, the alternative requirements of Sections ~~305-9.1~~ 508.9.1 through ~~305-9.4~~ 508.9.4 for that element shall be permitted.

Exception: Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in historic buildings.

~~305-9.1~~ 508.9.1 Site arrival points. Not fewer than one accessible route from a site arrival point to an accessible entrance shall be provided.

~~305-9.2~~ 508.9.2 Multiple-level buildings and facilities. An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

~~305-9.3~~ 508.9.3 Entrances. Not fewer than one main entrance shall be accessible.

Exception: If a public entrance cannot be made accessible, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with Section 1111 of the International Building Code shall be provided at the public entrance and the accessible entrance.

305.9.4 508.9.4 Toilet and bathing facilities. Where toilet rooms are provided, not fewer than one accessible family or assisted-use toilet room complying with Section 1109.2.1 of the International Building Code shall be provided.

Add new text as follows:

SECTION 405 **Accessibility**

405.1 General. Repairs shall be done in a manner that maintains the level of accessibility provided.

SECTION 705 **Accessibility**

705.1 General. Where compliance with this section is technically infeasible, the alteration shall provide access to the maximum extent that is technically feasible. A facility that is constructed or altered to be accessible shall be maintained accessible during construction.

Exceptions:

1. The altered element or space is not required to be on an accessible route unless required by Section 705.2.
2. Accessible means of egress required by Chapter 10 of the International Building Code are not required to be provided in existing facilities.
3. Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in existing facilities undergoing less than a Level 3 alteration.
4. The alteration to Type A individually owned dwelling units within a Group R-2 occupancy shall meet the provisions for Type B dwelling units.

705.2 Extent of application. An alteration of an existing element, space or area of a facility shall not impose a requirement for greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

705.3 Scoping. A facility that is altered shall comply with the applicable provisions of Sections 705.3.1 through 705.3.15, and Chapter 11 of the International Building Code unless it is technically infeasible.

705.3.1 Entrances. Where an alteration includes alterations to an entrance that is not accessible, and the facility has an accessible entrance, the altered entrance is not required to be accessible unless required by Section 705.4. Signs complying with Section 1111 of the International Building Code shall be provided.

705.3.2 Elevators. Altered elements of existing elevators shall comply with ASME A17.1 and ICC A117.1. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

705.3.3 Platform lifts. Platform (wheelchair) lifts complying with ICC A117.1 and installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

705.3.4 Ramps. Where slopes steeper than allowed by Section 1012.2 of the International Building Code are necessitated by space limitations, the slope of ramps in or providing access to existing facilities shall comply with Table.705.3.4.

**TABLE 705.3.4
RAMPS**

SLOPE	MAXIMUM RISE
Steeper than 1:10 but not steeper than 1:8	3 inches
Steeper than 1:12 but not steeper than 1:10	6 inches

For SI: inch = 25.4 mm

705.3.5 Dining areas An accessible route shall be provided throughout the dining area.

Exception: An accessible route to raised or sunken areas or to outdoor seating areas is not required provided the same services and decor are provided in an accessible space.

705.3.6 Accessible dwelling and sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added, the requirements of Section 1107 of the International Building Code for Accessible units apply only to the quantity of spaces being altered or added.

705.3.7 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being altered or added, the requirements of Section 1107 of the International Building Code for Type A units apply only to the quantity of the spaces being altered or added.

705.3.8 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements of Section 1107 of the International Building Code for Type B units apply only to the quantity of the spaces being added. Where Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered and where the work area is greater than 50 percent of the aggregate area of the building, the requirements of Section 1107 of the International Building Code for Type B units apply only to the quantity of the spaces being altered.

705.3.9 Jury boxes and witness stands. In alterations, accessible wheelchair spaces are not required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where the ramp or lift access restricts or projects into the required means of egress.

705.3.10 Toilet rooms. Where it is technically infeasible to alter existing toilet and bathing rooms to be accessible, an accessible family or assisted-use toilet or bathing room constructed in accordance with Section 1109.2.1 of the International Building Code is permitted. The family or assisted-use toilet or bathing room shall be located on the same floor and in the same area as the existing toilet or bathing rooms. At the inaccessible toilet and bathing rooms, directional signs indicating the location of the nearest family or assisted-use toilet room or bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

705.3.11 Additional toilet and bathing facilities. In assembly and mercantile occupancies, where additional toilet fixtures are added, not fewer than one accessible family or assisted-use toilet room shall be provided where required by Section 1109.2.1 of the International Building Code. In recreational facilities, where additional bathing rooms are being added, not fewer than one family or assisted-use bathing room shall be provided where required by Section 1109.2.1 of the International Building Code.

705.3.12 Dressing, fitting and locker rooms. Where it is technically infeasible to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level shall be provided. Where separate-sex facilities are provided, accessible rooms for each sex shall be provided. Separate-sex facilities are not required where only unisex rooms are provided.

705.3.13 Fuel dispensers. Operable parts of replacement fuel dispensers shall be permitted to be 54 inches (1370 mm) maximum, measuring from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

705.3.14 Thresholds The maximum height of thresholds at doorways shall be 3/4 inch (19.1 mm). Such thresholds shall have beveled edges on each side.

705.3.15 Amusement rides. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with requirements for new construction in Section 1110.4.8 of the International Building Code.

705.4 Alterations affecting an area containing a primary function. Where an alteration affects the accessibility to, or contains an area of primary function, the route to the primary function area shall be accessible. The accessible route to the primary function area shall include toilet facilities and drinking fountains serving the area of primary function.

Exceptions:

1. The costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of primary function.
2. This provision does not apply to alterations limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to alterations limited solely to mechanical systems, electrical systems, installation or alteration of fire protection systems and abatement of hazardous materials.

4. This provision does not apply to alterations undertaken for the primary purpose of increasing the accessibility of a facility.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

SECTION 806 **Accessibility**

806.1 General. A building, facility, or element that is altered shall comply with this section and Section 705.

806.2 Stairways and escalators in existing buildings. In alterations where an escalator or stairway is added where none existed previously, an accessible route shall be provided in accordance with Sections 1104.4 and 1104.5 of the International Building Code.

SECTION 906 **Accessibility**

906.1 General. A building, facility, or element that is altered shall comply with this section and Sections 705 and 806.

906.2 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered, the requirements of Section 1107 of the International Building Code for Type B units and Chapter 9 of the International Building Code for visible alarms apply only to the quantity of the spaces being altered.

Exception: Group I-1, I-2, R-2, R-3 and R-4 dwelling or sleeping units where the first certificate of occupancy was issued before March 15, 1991 are not required to provide Type B dwelling or sleeping units.

SECTION 1006 **Accessibility**

1006.1 General. Accessibility in portions of buildings undergoing a change of occupancy classification shall comply with Section 1011.

SECTION 1105 **Accessibility**

1105.1 Minimum requirements. Accessibility provisions for new construction shall apply to additions. An addition that affects the accessibility to, or contains an area of primary function, shall comply with the requirements of Sections 705, 806 and 906 as applicable.

1105.2 Accessible dwelling units and sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being added, the requirements of Section 1107 of the International Building Code for accessible units apply only to the quantity of spaces being added.

1105.3 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being added, the requirements of Section 1107 of the International Building Code for Type A units and Chapter 9 of the International Building Code for visible alarms apply only to the quantity of the spaces being added.

1105.4 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements of Section 1107 of the International Building Code for Type B units and Chapter 9 of the International Building Code for visible alarms apply only to the quantity of spaces being added.

SECTION 1204 **Accessibility**

1204.1 Accessibility requirements The provisions of Sections 705, 806 and 906, as applicable, shall apply to facilities designated as historic structures that undergo alterations or a change of occupancy, unless technically infeasible. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the facility, as determined by the authority having jurisdiction, the alternative requirements of Sections 1204.1.1 through 1204.4.4 for that element shall be permitted.

Exception: Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in historical buildings.

Revise as follows:

305.9.1 1204.1.1 Site arrival points. Not fewer than one accessible route from a site arrival point to an accessible entrance shall be provided.

305.9.2 1204.1.2 Multiple-level buildings and facilities. An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

305.9.3 1204.1.3 Entrances. Not fewer than one main entrance shall be accessible.

Exception: If a public entrance cannot be made accessible, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with Section 1111 of the International Building Code shall be provided at the public entrance and the accessible entrance.

~~305.9.4~~ **1204.1.4 Toilet and bathing facilities.** Where toilet rooms are provided, not fewer than one accessible family or assisted-use toilet room complying with Section 1109.2.1 of the International Building Code shall be provided.

Add new text as follows:

1301.2.6 Accessibility requirements. Accessibility shall be provided in accordance with Section 410 or 605.

Reason: The IEBC was set up many code cycles ago to offer three distinct options for compliance of existing buildings. By lumping all of the accessibility requirements into one chapter, there is no distinction for accessibility under any of the compliance methods. Previous editions of the IEBC offered code requirements for accessibility under each distinct compliance method. Those requirements should remain with each distinct compliance method as each method is designed to stand on its own merits.

This proposal is relocating the contents of Section 305 to the various chapters, depending on the compliance method. For the prescriptive method, the language in 305 has been moved to a new Section 508. For the work area compliance method, the language in 305 has been moved to Section 705. In addition to the language in Section 705, language has been added to cover the other work area options including repairs, Level 2 alterations, Level 3 alterations, change of occupancy, additions and historic buildings. For the performance compliance method, a section has been added to direct the user to comply with either the prescriptive method or the language for repairs.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is just reformatting current language so there is no impact to the construction cost.

EB5-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The movement of the accessibility provisions back to where they were in the 2015 was seen as unnecessary. It was noted that a review of Chapters 1, 2 and 3 would occur in every project and it simplifies compliance having the requirements in Chapter 3. It was noted that dining areas were intentionally deleted in the 2018 IEBC. (Vote: 13-0)

Assembly Action:

None

EB5-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com)

requests As Submitted

Commenter's Reason: The IEBC was set up many code cycles ago to offer three distinct options for compliance of existing buildings. By lumping all of the accessibility requirements into one chapter, there is no distinction for accessibility under any of the compliance methods. Previous editions of the IEBC offered code requirements for accessibility under each distinct compliance method. Those requirements should remain with each distinct compliance method as each method is designed to stand on its own merits.

The committee said this code change was unnecessary as that every project would be reviewed using Chapter 1, 2 and 3. Rather than make assumptions that every project would be reviewed using those chapter, it would be easier to provide for all of the individual provisions to have the accessibility provisions contained within the parameters for that provision. This code change allows for that to happen.

As far as the dining provision, EB 35 of this cycle is an attempt to add it back into the 2021 IEBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This is just reformatting current language so there is no impact to the construction cost.

Public Comment# 1593

EB6-19

IEBC@: 306, SECTION 401, 306.1, 306.2, [BS] 306.3, SECTION 402, 306.4, SECTION 403, 306.5, SECTION 404, 306.6, SECTION 405, [BS] 306.7, [BS] 306.7.1, [BS] 306.7.1.1, [BS] 306.7.1.1.1, [BS] 306.7.1.2, [BS] 306.7.1.3, [BS] 306.7.1.3.1, [BS] 306.7.1.3.2, [BS] 306.7.1.3.3, [BS] 306.7.1.4, [BS] 306.7.1.4.1, [BS] 306.7.1.5, SECTION 406, 306.8, 306.8.1, 306.8.2, 306.8.3, 306.8.4, 306.8.5, SECTION 407, 306.9, 306.9.1, SECTION 408, 306.10, 306.10.1

Proposed Change as Submitted

Proponents: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com)

2018 International Existing Building Code

Revise as follows:

4 306 REPAIRS

Delete without substitution:

SECTION 401 GENERAL

Revise as follows:

~~401-1 306.1~~ **Scope.** *Repairs* shall comply with the requirements of this chapter. ~~Section 306.~~ *Repairs to historic buildings* need only comply with Chapter 12.

~~401-2 306.2~~ **Compliance.** The work shall not make the building less complying than it was before the *repair* was undertaken.

[BS] ~~401-3 306.3~~ **Flood hazard areas.** In flood hazard areas, *repairs* that constitute *substantial improvement* shall require that the building comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

Delete without substitution:

SECTION 402 BUILDING ELEMENTS AND MATERIALS

Revise as follows:

~~402-1 306.4~~ **Glazing in hazardous locations.** Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the International Building Code or International Residential Code as applicable.

Exception: Glass block walls, louvered windows and jalousies repaired with like materials.

Delete without substitution:

SECTION 403 FIRE PROTECTION

Revise as follows:

~~403-1 306.5~~ **General: Fire Protection.** *Repairs* shall be done in a manner that maintains the level of fire protection provided.

Delete without substitution:

SECTION 404 MEANS OF EGRESS

Revise as follows:

~~404-1 306.6~~ **General: Means of Egress.** *Repairs* shall be done in a manner that maintains the level of protection provided for the means of egress.

Delete without substitution:

SECTION 405 STRUCTURAL

Revise as follows:

[BS] ~~405.1 306.7~~ **General Structural.** Structural *repairs* shall be in compliance with this section and Section ~~401.2-306.2~~

[BS] ~~405.2 306.7.1~~ **Repairs to damaged buildings.** *Repairs* to damaged buildings shall comply with this section.

[BS] ~~405.2.1 306.7.1.1~~ **Repairs for less than substantial structural damage.** Unless otherwise required by this section, for damage less than *substantial structural damage*, the damaged elements shall be permitted to be restored to their predamage condition.

[BS] ~~405.2.1.1 306.7.1.1.1~~ **Snow damage.** Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the International Building Code.

[BS] ~~405.2.2 306.7.1.2~~ **Disproportionate earthquake damage.** A building assigned to Seismic Design Category D, E or F that has sustained *disproportionate earthquake damage* shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

[BS] ~~405.2.3 306.7.1.3~~ **Substantial structural damage to vertical elements of the lateral force-resisting system.** A building that has sustained *substantial structural damage* to the vertical elements of its lateral force-resisting system shall be evaluated in accordance with Section ~~405.2.3.1 306.7.1.3.1~~, and either repaired in accordance with Section ~~405.2.3.2 306.7.1.3.2~~ or repaired and retrofitted in accordance with Section ~~405.2.3.3 306.7.1.3.3~~, depending on the results of the evaluation.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose *substantial structural damage* was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] ~~405.2.3.1 306.7.1.3.1~~ **Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the *code official*. The evaluation shall establish whether the damaged building, if repaired to its predamage state, would comply with the provisions of the International Building Code for load combinations that include wind or earthquake effects, except that the seismic forces shall be the reduced seismic forces.

[BS] ~~405.2.3.2 306.7.1.3.2~~ **Extent of repair for compliant buildings.** If the evaluation establishes that the building in its predamage condition complies with the provisions of Section ~~405.2.3.1 306.7.1.3.1~~, then the damaged elements shall be permitted to be restored to their predamage condition.

[BS] ~~405.2.3.3 306.7.1.3.3~~ **Extent of repair for noncompliant buildings.** If the evaluation does not establish that the building in its predamage condition complies with the provisions of Section ~~405.2.3.1 306.7.1.3.1~~, then the building shall be retrofitted to comply with the provisions of this section. The wind loads for the *repair* and *retrofit* shall be those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the International Building Code. The seismic loads for this *retrofit* design shall be those required by the building code in effect at the time of original construction, but not less than the reduced seismic forces.

[BS] ~~405.2.4 306.7.1.4~~ **Substantial structural damage to gravity load-carrying components.** Gravity load-carrying components that have sustained *substantial structural damage* shall be rehabilitated to comply with the applicable provisions for dead and live loads in the International Building Code. Snow loads shall be considered if the *substantial structural damage* was caused by or related to snow load effects. Undamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated if required to comply with the design loads of the *rehabilitation* design.

[BS] ~~405.2.4.1 306.7.1.4.1~~ **Lateral force-resisting elements.** Regardless of the level of damage to vertical elements of the lateral force-resisting system, if *substantial structural damage* to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section ~~405.2.3.1 306.7.1.3.1~~ and, if noncompliant, retrofitted in accordance with Section ~~405.2.3.3 306.7.1.3.3~~.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B, or C whose substantial structural damage was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] ~~405.2.5 306.7.1.5~~ **Flood hazard areas.** In *flood hazard* areas, buildings that have sustained *substantial damage* shall be brought into compliance with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

Delete without substitution:

SECTION 406 ELECTRICAL

Revise as follows:

~~406-1-306.8~~ **Material- Electrical.** Existing electrical wiring and equipment undergoing *repair* shall be allowed to be repaired or replaced with like material.

~~406-1-1-306.8.1~~ **Receptacles.** Replacement of electrical receptacles shall comply with the applicable requirements of Section 406.4(D) of NFPA 70.

~~406-1-2-306.8.2~~ **Plug fuses.** Plug fuses of the Edison-base type shall be used for replacements only where there is no evidence of over fusing or tampering per applicable requirements of Section 240.51(B) of NFPA 70.

~~406-1-3-306.8.3~~ **Nongrounding-type receptacles.** For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system or to any accessible point on the grounding electrode conductor in accordance with Section 250.130(C) of NFPA 70.

~~406-1-4-306.8.4~~ **Group I-2 receptacles.** Receptacles in patient bed locations of Group I-2 that are not “hospital grade” shall be replaced with “hospital grade” receptacles, as required by NFPA 99 and Article 517 of NFPA 70.

~~406-1-5-306.8.5~~ **Grounding of appliances.** Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers and outlet or junction boxes that are part of the existing branch circuit for these appliances shall be permitted to be grounded to the grounded circuit conductor in accordance with Section 250.140 of NFPA 70.

Delete without substitution:

~~SECTION 407~~
~~MECHANICAL~~

Revise as follows:

~~407-1-306.9~~ **General- Mechanical.** Existing mechanical systems undergoing *repair* shall not make the building less complying than it was before the damaged occurred.

~~407-2-306.9.1~~ **Mechanical draft systems for manually fired appliances and fireplaces.** A mechanical draft system shall be permitted to be used with manually fired appliances and fireplaces where such a system complies with all of the following requirements:

1. The mechanical draft device shall be listed and installed in accordance with the manufacturer’s installation instructions.
2. A device shall be installed that produces visible and audible warning upon failure of the mechanical draft device or loss of electrical power at any time that the mechanical draft device is turned on. This device shall be equipped with a battery backup if it receives power from the building wiring.
3. A smoke detector shall be installed in the room with the appliance or fireplace. This device shall be equipped with a battery backup if it receives power from the building wiring.

Delete without substitution:

~~SECTION 408~~
~~PLUMBING~~

Revise as follows:

~~408-1-306.10~~ **Materials- Plumbing.** Plumbing materials and supplies shall not be used for *repairs* that are prohibited in the International Plumbing Code .

~~408-2-306.10.1~~ **Water closet replacement.** The maximum water consumption flow rates and quantities for all replaced water closets shall be 1.6 gallons (6 L) per flushing cycle.

Exception: Blowout-design water closets [3.5 gallons (13 L) per flushing cycle].

Reason: The purpose of this code change is to pull the provisions for repairs from Chapter 4 and put them in Chapter 3 which covers general provisions as repairs can occur using any of the compliance methods with the requirements being the same for each method.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact as this is just moving current language to another location within the body of the code.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that the repairs section should remain in an independent chapter as revised for the 2018 code. Placement in Chapter 3 seemed unnecessary as the provisions can stand on their own in Chapter 4. (Vote: 13-0)

Assembly Action:

None

EB6-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com)

requests As Submitted

Commenter's Reason: The purpose of this code change is to pull the provisions for repairs from Chapter 4 and put them in Chapter 3 which covers general provisions as repairs can occur using any of the compliance methods with the requirements being the same for each method.

The committee felt that the repairs should stand on their own merit. However, Chapter 3 also includes accessibility provisions which could also be deemed a separate stand alone item. Generally the I Codes are set up so that common elements are located in one chapter. If repairs can apply to any of the three methods why would not all of the provisions that apply to all three methods be provided for in one chapter, thus providing the designer all of the requirements they need to meet in one location?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is just moving current language to another location within the body of the code so there is no cost associated with this change.

Staff Analysis: Note that Code Change Proposals and associated public comments to EB6-19, EB7-19 and EB50-19 take differing approaches as to how repairs should be addressed in the IEBC. The voting membership should consider the differences and make their intentions clear.

Public Comment# 1594

EB7-19

IEBC®: CHAPTER 4, SECTION 401, 401.1, 401.1.1, SECTION 402, SECTION 403, SECTION 404 (New), 404.1 (New), 404.2 (New), 404.2.1 (New), 404.2.1.1 (New), 404.2.2 (New), 404.2.3 (New), 404.2.3.1 (New), 404.2.3.2 (New), 404.2.3.3 (New), 404.2.4 (New), 404.2.4.1 (New), 404.2.5 (New), SECTION 405, SECTION 406, SECTION 407, SECTION 408, CHAPTER 5, SECTION 501, SECTION 502 (New), 502.1 (New), 502.2 (New), 502.3 (New), SECTION 503, SECTION 504, SECTION 505, SECTION 506, SECTION 507, SECTION 508, SECTION 509, CHAPTER 6, SECTION 601, 601.1, 601.2, [BS] 601.3, SECTION 602, 602.1, SECTION 603, 603.1, SECTION 604, 604.1, SECTION 605, [BS] 605.1, [BS] 605.2, [BS] 605.2.1, [BS] 605.2.1.1, [BS] 605.2.2, [BS] 605.2.3, [BS] 605.2.3.1, [BS] 605.2.3.2, [BS] 605.2.3.3, [BS] 605.2.4, [BS] 605.2.4.1, [BS] 605.2.5, SECTION 606, 606.1, 606.1.1, 606.1.2, 606.1.3, 606.1.4, 606.1.5, SECTION 607, 607.1, 607.2, SECTION 608, 608.1, 608.2, 1301.2.4

Proposed Change as Submitted

Proponents: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com)

2018 International Existing Building Code

CHAPTER 5 4 PRESCRIPTIVE COMPLIANCE METHOD

SECTION 501 401 GENERAL

Revise as follows:

~~501.1~~ **401.1 Scope.** The provisions of this chapter shall control the *alteration, repair, addition and change of occupancy of existing buildings and structures, including historic buildings and structures as referenced in Section 301.3.2.*

Exception: Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

~~501.1.1~~ **401.1.1 Compliance with other methods.** *Alterations, repairs, additions and changes of occupancy to existing buildings and structures shall comply with the provisions of this chapter or with one of the methods provided in Section 301.3.*

SECTION 502 402 ADDITIONS

SECTION 503 403 ALTERATIONS

Add new text as follows:

SECTION 404 REPAIRS

404.1 General. Buildings and structures, and parts thereof, shall be repaired in compliance with Section 404.

404.2 Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

404.2.1 Repairs for less than substantial structural damage. Unless otherwise required by this section, for damage less than substantial structural damage, the damaged elements shall be permitted to be restored to their predamaged condition.

404.2.1.1 Snow damage. Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the International Building Code.

404.2.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained disproportionate earthquake damage shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

404.2.3 Substantial structural damage to vertical elements of the lateral force-resisting system. A building that has sustained substantial structural damage to the vertical elements of its lateral force resisting system shall be evaluated in accordance with Section 404.2.3.1, and either repaired in accordance with Section 404.2.3.2 or repaired and retrofitted in accordance with Section 404.2.3.3, depending on the results of the evaluation.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose substantial structural damage was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.

2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

404.2.3.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluation shall establish whether the damaged building, if repaired to its predamage state, would comply with the provisions of the International Building Code for load combinations that include wind or earthquake effects, except that the seismic forces shall be the reduced seismic forces.

404.2.3.2 Extent of repair for compliant buildings. If the evaluation establishes that the building in its predamage condition complies with the provisions of Section 404.2.3.1, then the damaged elements shall be permitted to be restored to their predamage condition.

404.2.3.3 Extent of repair for noncompliant buildings. If the evaluation does not establish that the building in its predamage condition complies with the provisions of Section 404.2.3.1, then the building shall be retrofitted to comply with the provisions of this section. The wind loads for the repair and retrofit shall be those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the International Building Code. The seismic loads for this retrofit design shall be those required by the building code in effect at the time of original construction, but not less than the reduced seismic forces.

404.2.4 Substantial structural damage to gravity load-carrying components. Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead and live loads in the International Building Code. Snow loads shall be considered if the substantial structural damages was caused by or related to snow load effects. Undamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated if required to comply with the design loads of the rehabilitation design.

404.2.4.1 Lateral force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 404.2.3.1 and, if noncompliant, retrofitted in accordance with Section 404.2.3.3.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose substantial structural damage was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One-and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

404.2.5 Flood hazard areas. In flood hazard areas, buildings that have sustained substantial damage shall be brought into compliance with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

**SECTION 504 405
FIRE ESCAPES**

**SECTION 505 406
WINDOWS AND EMERGENCY ESCAPE OPENINGS**

**SECTION 506 407
CHANGE OF OCCUPANCY**

**SECTION 507 408
HISTORIC BUILDINGS**

**CHAPTER 6 5
CLASSIFICATION OF WORK**

**SECTION 601 501
GENERAL**

Add new text as follows:

**SECTION 502
REPAIRS**

502.1 Scope. Repairs, as defined in Chapter 2, include the patching or restoration or replacement of damaged materials, elements, equipment or fixtures for the purpose of maintaining such components in good or sound condition with respect to existing loads or performance requirements.

502.2 Application. Repairs shall comply with the provisions of Chapter 6.

502.3 Related Work. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the provisions of Chapter 7, 8, 9, 10 or 11.

SECTION ~~602~~ 503
ALTERATION—LEVEL 1

SECTION ~~603~~ 504
ALTERATION—LEVEL 2

SECTION ~~604~~ 505
ALTERATION—LEVEL 3

SECTION ~~605~~ 506
CHANGE OF OCCUPANCY

SECTION ~~606~~ 507
ADDITIONS

SECTION ~~607~~ 508
HISTORIC BUILDINGS

SECTION ~~608~~ 509
RELOCATED BUILDINGS

CHAPTER 4 6
REPAIRS

SECTION ~~401~~ 601
GENERAL

Revise as follows:

~~401-1~~ **601.1 Scope.** *Repairs as described in Section 502 shall comply with the requirements of this chapter. Repairs to historic buildings need only comply with Chapter 12.*

~~401-2~~ **601.2 Compliance.** The work shall not make the building less complying than it was before the *repair* was undertaken.

[BS] ~~401-3~~ **601.3 Flood hazard areas.** In flood hazard areas, *repairs* that constitute *substantial improvement* shall require that the building comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

SECTION ~~402~~ 602
BUILDING ELEMENTS AND MATERIALS

~~402-1~~ **602.1 Glazing in hazardous locations.** Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the International Building Code or International Residential Code as applicable.

Exception: Glass block walls, louvered windows and jalousies repaired with like materials.

SECTION ~~403~~ 603
FIRE PROTECTION

~~403-1~~ **603.1 General.** *Repairs* shall be done in a manner that maintains the level of fire protection provided.

SECTION ~~404~~ 604
MEANS OF EGRESS

~~404-1~~ **604.1 General.** *Repairs* shall be done in a manner that maintains the level of protection provided for the means of egress.

SECTION ~~405~~ 605
STRUCTURAL

[BS] ~~405-1~~ **605.1 General.** Structural *repairs* shall be in compliance with this section and Section ~~401-2-~~ 601.2.

[BS] ~~405-2~~ **605.2 Repairs to damaged buildings.** *Repairs* to damaged buildings shall comply with this section.

[BS] ~~405-2-1~~ **605.2.1 Repairs for less than substantial structural damage.** Unless otherwise required by this section, for damage less than *substantial structural damage*, the damaged elements shall be permitted to be restored to their predamage condition.

[BS] ~~405.2.1.1~~ 605.2.1.1 Snow damage. Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the International Building Code.

[BS] ~~405.2.2~~ 605.2.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained *disproportionate earthquake damage* shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

[BS] ~~405.2.3~~ 605.2.3 Substantial structural damage to vertical elements of the lateral force-resisting system. A building that has sustained *substantial structural damage* to the vertical elements of its lateral force-resisting system shall be evaluated in accordance with Section ~~405.2.3.1~~ 605.2.3.1, and either repaired in accordance with Section ~~405.2.3.2~~ 605.2.3.2 or repaired and retrofitted in accordance with Section ~~405.2.3.3~~ 605.2.3.3, depending on the results of the evaluation.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose *substantial structural damage* was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] ~~405.2.3.1~~ 605.2.3.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the *code official*. The evaluation shall establish whether the damaged building, if repaired to its predamage state, would comply with the provisions of the International Building Code for load combinations that include wind or earthquake effects, except that the seismic forces shall be the reduced seismic forces.

[BS] ~~405.2.3.2~~ 605.2.3.2 Extent of repair for compliant buildings. If the evaluation establishes that the building in its predamage condition complies with the provisions of Section ~~405.2.3.1~~ 605.2.3.1, then the damaged elements shall be permitted to be restored to their predamage condition.

[BS] ~~405.2.3.3~~ 605.2.3.3 Extent of repair for noncompliant buildings. If the evaluation does not establish that the building in its predamage condition complies with the provisions of Section ~~405.2.3.1~~ 605.2.3.1, then the building shall be retrofitted to comply with the provisions of this section. The wind loads for the *repair* and *retrofit* shall be those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the International Building Code. The seismic loads for this *retrofit* design shall be those required by the building code in effect at the time of original construction, but not less than the reduced seismic forces.

[BS] ~~405.2.4~~ 605.2.4 Substantial structural damage to gravity load-carrying components. Gravity load-carrying components that have sustained *substantial structural damage* shall be rehabilitated to comply with the applicable provisions for dead and live loads in the International Building Code. Snow loads shall be considered if the *substantial structural damage* was caused by or related to snow load effects. Undamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated if required to comply with the design loads of the *rehabilitation* design.

[BS] ~~405.2.4.1~~ 605.2.4.1 Lateral force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if *substantial structural damage* to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section ~~405.2.3.1~~ 605.2.3.1 and, if noncompliant, retrofitted in accordance with Section ~~405.2.3.3~~ 605.2.3.3.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B, or C whose substantial structural damage was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] ~~405.2.5~~ 605.2.5 Flood hazard areas. In *flood hazard areas*, buildings that have sustained *substantial damage* shall be brought into compliance with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

SECTION 406 606 ELECTRICAL

~~406.1~~ 606.1 Material. Existing electrical wiring and equipment undergoing *repair* shall be allowed to be repaired or replaced with like material.

~~406.1.1~~ 606.1.1 Receptacles. Replacement of electrical receptacles shall comply with the applicable requirements of Section 406.4(D) of NFPA 70.

~~406.1.2~~ 606.1.2 Plug fuses. Plug fuses of the Edison-base type shall be used for replacements only where there is no evidence of over fusing or tampering per applicable requirements of Section 240.51(B) of NFPA 70.

~~406.1.3~~ 606.1.3 Nongrounding-type receptacles. For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system or to any accessible point on the grounding

electrode conductor in accordance with Section 250.130(C) of NFPA 70.

~~406-1.4~~ **606.1.4 Group I-2 receptacles.** Receptacles in patient bed locations of Group I-2 that are not “hospital grade” shall be replaced with “hospital grade” receptacles, as required by NFPA 99 and Article 517 of NFPA 70.

~~406-1.5~~ **606.1.5 Grounding of appliances.** Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers and outlet or junction boxes that are part of the existing branch circuit for these appliances shall be permitted to be grounded to the grounded circuit conductor in accordance with Section 250.140 of NFPA 70.

SECTION 407 607 MECHANICAL

~~407-1~~ **607.1 General.** Existing mechanical systems undergoing *repair* shall not make the building less complying than it was before the damaged occurred.

~~407-2~~ **607.2 Mechanical draft systems for manually fired appliances and fireplaces.** A mechanical draft system shall be permitted to be used with manually fired appliances and fireplaces where such a system complies with all of the following requirements:

1. The mechanical draft device shall be listed and installed in accordance with the manufacturer’s installation instructions.
2. A device shall be installed that produces visible and audible warning upon failure of the mechanical draft device or loss of electrical power at any time that the mechanical draft device is turned on. This device shall be equipped with a battery backup if it receives power from the building wiring.
3. A smoke detector shall be installed in the room with the appliance or fireplace. This device shall be equipped with a battery backup if it receives power from the building wiring.

SECTION 408 608 PLUMBING

~~408-1~~ **608.1 Materials.** Plumbing materials and supplies shall not be used for *repairs* that are prohibited in the International Plumbing Code .

~~408-2~~ **608.2 Water closet replacement.** The maximum water consumption flow rates and quantities for all replaced water closets shall be 1.6 gallons (6 L) per flushing cycle.

Exception: Blowout-design water closets [3.5 gallons (13 L) per flushing cycle].

~~1301.2.4 Alterations-~~ **Alterations and repairs.** An *existing building* or portion thereof shall not be altered or repaired in such a manner that results in the building being less safe or sanitary than such building is currently. Exception: Where the current level of safety or sanitation is proposed to be reduced, the portion altered or repaired shall conform to the requirements of the International Building Code.

Reason: The IEBC was set up many code cycles ago to offer three distinct options for compliance of existing buildings. By lumping all of the repair requirements into one chapter, there is no distinction for repairs under any of the compliance methods. Previous editions of the IEBC offered code requirements for repairs under each distinct compliance method. Those requirements should remain with each distinct compliance method as each method is designed to stand on its own merits.

This proposed code change is moving the language from Chapter 4, Repairs, to become its own Chapter under the Work Area Compliance Method as well as providing language in the Prescriptive Method and the Compliance Method. The intention is that this relocation puts the repair language in the appropriate compliance method, depending on which method is utilized by the designer.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact with this code change as it is only relocating language.

EB7-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was seen as inconsistent with previous actions as to where the repair provisions should be located. The current code structure for repairs was preferred. (Vote: 13-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com)

requests As Submitted

Commenter's Reason: The IEBC was set up many code cycles ago to offer three distinct options for compliance of existing buildings. By lumping all of the repair requirements into one chapter, there is no distinction for repairs under any of the compliance methods. Previous editions of the IEBC offered code requirements for repairs under each distinct compliance method. Those requirements should remain with each distinct compliance method as each method is designed to stand on its own merits.

This proposed code change is moving the language from Chapter 4, Repairs, to become its own Chapter under the Work Area Compliance Method as well as providing language in the Prescriptive Method and the Compliance Method. The intention is that this relocation puts the repair language in the appropriate compliance method, depending on which method is utilized by the designer.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost impact with this code change as it is only relocating language.

Staff Analysis: Note that Code Change Proposals and associated public comments to EB6-19, EB7-19 and EB50-19 take differing approaches as to how repairs should be addressed in the IEBC. The voting membership should consider the differences and make their intentions clear.

Public Comment# 1595

EB16-19

IEBC@: 303.4 (New); IBC@: ACI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Kenneth Lozen, International Concrete Repair Institute, representing International Concrete Repair Institute (kenl@icri.org); Charles Hanskat, American Shotcrete Association, representing American Shotcrete Association (charles.hanskat@shotcrete.org); Randy Shackelford, P.E., Simpson Strong-Tie Co., representing Simpson Strong-Tie Co. (rshackelford@strongtie.com); Keith Kesner, CVM Engineers, representing CVM Professional; David Whitmore, Vector Corrosion Technologies Ltd., representing Vector Corrosion Technologies Ltd. (davidw@vector-corrosion.com); Kyle Stanish, Klein & Hoffman, representing Klein & Hoffman (kstanish@kleinandhoffman.com); Garth Fallis, Vector Construction Ltd., representing Vector Construction Ltd. (garthf@vector-construction.com); Matt Miltenberger, Vector Corrosion Services Inc., representing Vector Corrosion Services Inc. 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Moore and Associates, representing Walter P. Moore and Associates, Inc. (dlandis@walterpmoore.com); Samuel Park, WMATA, representing self; Pete Barlow, Contech Services, Inc., representing Contech Services, Inc. (pete@contechserviceswa.com); Jeff Barnes, representing ICRI (jeff@barnes-consulting.com); Evan Hammel, Simpson Strong-Tie (ehammel@strongtie.com); Young-Jin Cha (young.cha@umanitoba.ca); Jonathan Clavet, Sika Canada, representing Sika Canada inc. (clavet.jonathan@ca.sika.com); Jack Zhao, The City of Ottawa, representing Self (jackq.zhao@ottawa.ca); Eric Bellerose, BauVal Group, representing ICRI Quebec Chapter (ebellerose@bauval.com); David Renn, City and County of Denver, representing self (david.renn@denvergov.org); Karl Rickert, Rickert Engineering, Inc., representing Rickert Engineering, Inc. (kjricket@rickertengineering.com); Dennis Wipf, representing self (dlw@gervasioeng.com)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Add new text as follows:

303.4 Concrete evaluation and design procedures. Evaluation and design of repairs of structural concrete in compliance with ACI 562 and this code shall be permitted. ACI 562 shall not be used to comply with provisions of this code that involve the classification of earthquake damage or the evaluation or retrofit of structures using load combinations that include earthquake load effects. The following Sections of ACI 562 are not applicable:

1. Section 1.3.8 for seismic resistance
2. Section 4.1.4 for determining the rehabilitation category of work

3. [Section 4.7 for additions](#)
4. [Section 4.8 for alterations](#)
5. [Section 4.9 for change in occupancy](#)

2018 International Building Code

Add new standard(s) as follows:

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills MI 48331

562-19: Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures

Reason: Concept – This code change proposal adds ACI 562: *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*, to establish minimum requirements for the design, construction, repair, and rehabilitation of concrete structural elements in buildings for various levels of desired performance as deemed appropriate for the project. In addition to improved life safety, the requirements clearly define objectives and anticipated performance for the code official, owners, designers, contractors and installers. The proposed language is permissive, allowing other methods to be used to comply with the intent of the building code. Further Section 104.11 of the IEBC allows for alternative design methods:

"104.11 Alternative materials, design and methods of construction, and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design, or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method, or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the code official shall respond in writing, stating the reasons why the alternative was not approved."

The public discussion version of this standards is available at: www.concrete.org/publications/standards/upcomingstandards.aspx

Background – In 2006, the repair industry approached ACI asking for a concrete repair and rehabilitation code that would improve the overall quality of concrete repairs by establishing common requirements and establishing clear responsibilities between owners, designers, and contractors. This code would also provide building code officials with a reference by which to evaluate rehabilitated concrete structures. ACI, following its rigorous American National Standards Institute accredited standards development process assembled a code committee with balanced representation and produced the first official code in 2012. The committee members reviewed and considered numerous reports and publications related to concrete repair and rehabilitation to identify and develop requirements consistent with current industry practice. The committee has received feedback from users of the code and are now completing their third version of this code, ACI 562-19.

Scope – ACI 562-19 complements the IEBC by providing specific direction on how to design concrete repairs and how to handle the unique construction problems associated with repair. This standard helps the designer assess the existing structure in accordance with the IEBC. The standard then provides the requirements that bridge the inconsistencies and gaps in acceptable criteria that occur from the two following situations that a designer must solve: one, repairing a structure according to the original building code used at the time it was built using today's construction methods and materials; or, repairing a structure built according to an older building code but repaired according to the latest building code. Note that ACI 562 does not directly address the evaluation of lateral-force resisting systems in high seismic areas. ASCE 41 is the appropriate standard for this situation as stated in the IEBC and ACI 562.

Benefits – There are many benefits that ACI 562 provides for the designer, owner, contractor, materials providers, building code official and the public. A few of these benefits are:

- Provides a level of expectation of life safety to the public in buildings where repairs or rehabilitation is performed on concrete structural elements.
- Provides clearly defined, uniform requirements aimed at extending the service life of existing structures.
- Provides minimum requirements for safety and quality of concrete repair.
- Establishes clear responsibilities between owners, designers, and contractors.
- Provides building code officials with a means to evaluate rehabilitation designs.
- Provides specific repair requirements that often result in less costly repairs compared to repairs required to meet only new construction requirements.

Flexibility – ACI 562 permits flexibility in evaluation, design, construction and repair materials to provide economies while establishing expected performance for the service-life of the rehabilitation or repairs.

Resources – Also, there many resources that complement ACI 562. Among these are:

- *Concrete Repair Manual: Fourth Edition 2013*
- ACI 563-18, *Specifications for Repair of Structural Concrete in Buildings*
- MNL-3(16) *Guide to the Code for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*

These resources are readily available to provide greater understanding of assessment, repair and rehabilitation of concrete structural elements. ACI MNL-3 provides case studies demonstrating the ease of use of ACI 562. Numerous technical notes, reports, guides, and specifications that provide background information and technical support are available through other organizations, such as American Society of Civil Engineers, British Research Establishment, Concrete Society, International Concrete Repair Institute, National Association of Corrosion Engineers, Post-Tensioning Institute, Society for Protective Coatings, and US Army Corps of Engineers. Many of these organizations publications related to concrete repair can be found in the Concrete Repair Manual.

Sustainability - Reference of ACI 562 in the IEBC will help improve the confidence of owners, builders, and developers regarding effective repairs, upgrades, and reuse of existing buildings in lieu of demolition and replacement. Typically, extending the life of existing buildings is substantially more sustainable than demolition and new construction. Adoption of ACI 562 by reference is needed to help facilitate efforts that conserve energy and resources while maintaining a minimum level of requirements to ensure reasonable levels of life safety, and welfare are afforded to the public.

State and Local Adoptions – Jurisdictions see the need for these requirements. As the model for state and local adoptions, the IEBC should include this reference with appropriate charging language. ACI 562 is already being used in several jurisdictions:

Hawaii: Hawaii was the first state to adopt ACI 562 by reference. The following provisions are included in the State Building Code Council HAWAII STATE BUILDING CODE, which became effective on November 13, 2018:

“3401.6 Alternative compliance.

- 1) Work performed in accordance with the International Existing Building Code shall be deemed to comply with the provisions of this chapter.
- 2) Work performed in accordance with the 2016 version of the American Concrete Institute Committee 562, “Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures” shall be deemed to comply with this chapter when used as a supplement to the requirements of this chapter or the International Existing Building Code. Wherever the term International Existing Building Code (IEBC) is used in ACI 562-16, it shall mean International Existing Building Code or Chapter 34 of the International Building Code.”

Ohio: The Ohio Board of Building Standards Ohio adopted rule changes identified as Amendments Group 95. Included in this group is:

3401.6 Concrete evaluation and design procedures. Evaluation and design of structural concrete repairs and rehabilitation shall be in compliance with Chapter 34 and ACI 562.

ACI, a professional technical society, has developed this standard in response to industry needs and to help assure minimum levels of life safety results where repairs and rehabilitation are associated with concrete structural elements. For this reason and the other benefits identified in this reason statement, ACI recommends this code change proposal for committee approval as submitted.

New York City: The New York City Buildings Department issued *BUILDINGS BULLETIN 2015-017* in December 2017 Conditions of Acceptance for Fiber Reinforced Cementitious Matrix strengthening systems.

FRCM shall comply with the NYC Construction Codes and the following applicable provisions:

A. Design

1. FRCM system shall be designed in accordance with the ACI 549.4R-132 Guide for the Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix (FRCM) Systems for Repair and Strengthening Concrete and Masonry Structures with properties used for design obtained from tests performed in accordance with AC 434. Fire-resistance-rating and interior finish requirements shall be in accordance with the NYC Construction Codes, manufacturer’s recommendations and the conditions of the required listing.
2. For repairs and upgrade achieved with unprotected external FRCM, the increase in flexural or shear strength provided by the external reinforcing system shall not exceed 50% of the existing structural capacity of the member prior to strengthening. This increase should be checked before applying the strength reduction factor.
3. Careful consideration should be given to determine reasonable strengthening limits. These limits are imposed to guard against collapse of the structure should bond or other failure of the FRCM system occur due to damage, vandalism, or other causes. The required strength of a structure without repair should be as specified in in accordance with ACI 562 *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures* Section 5.5.

Recommendation – ACI, a professional technical society, has developed this ACI 562 in response to industry needs and to help assure minimum

levels of life safety, health, and welfare for the public. For this reason and the other benefits identified in this reason statement, ACI recommends this code change proposal for committee approval as submitted.

Bibliography: Concrete Repair Manual - 4th Edition: 2-Volume Set, ACI and ICRI, 2013, 2093 pp.
https://www.concrete.org/store/productdetail.aspx?ItemID=RPMN13PACK&Format=HARD_COPY

Guide to the Code for Assessment, Repair, and Rehabilitation of Existing Concrete Buildings, ACI and ICRI, 2016, 176 pp.

<https://www.concrete.org/store/productdetail.aspx?ItemID=MNL316&Language=English>

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptance criteria that is amicable to both the owner and the building code official. The result is the determination that the repair must meet the latest building code requirements for new construction. This standard increases the options available for repair and provides the acceptance criteria necessary to permit these options. A case study that illustrates this point: "ACI 562 has been referenced in expert reports for litigation cases, resulting in significantly reduced financial settlements. Denver-based J. R. Harris & Company recently used the code as a standard in several litigation reports assessing damages in existing concrete structures. As an approved consensus standard, according to American National Standards Institute (ANSI) procedures, ACI 562-13 has been accepted as the source standard to use for damage assessment and repair on individual projects by Greenwood Village and Pikes Peak Regional Building Departments in Colorado. Based on this acceptance, the consulting engineer was able to cite the code in their recommendation for structural remediation and determination of damages. In one case involving rehabilitation work on four buildings with faulty construction, J.R. Harris was able to reduce the repair costs from \$12 million to \$3 million, with a repair plan based on the lesser of the demand-capacity ratio based on either the original or current building code per ACI 562."

Staff Analysis: A review of the standard proposed for inclusion in the code, ACI 562-19, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

EB16-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proposed reference standards, ACI Standard 562, is currently provided in draft format with additional changes anticipated, which are not currently available for review. Proposed language could create inconsistencies. Proposed change would be hard to enforce and uses language such as 'shall be permitted'. (Vote: 9-4)

Assembly Action:

None

EB16-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 303.4 (New); IBC@: ACI Chapter 35 (New)

Proponents:

Kerry Sutton, American Concrete Institute, representing American Concrete Institute (kerry.sutton@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

303.4 Concrete evaluation and design procedures. Evaluation and design of repairs of structural concrete shall be in compliance with ACI 562 and this code ~~shall be permitted~~. ACI 562 shall not be used to comply with provisions of this code that involve the classification of earthquake damage or the evaluation or retrofit of structures using load combinations that include earthquake load effects. ~~The following Sections of ACI 562 are not applicable:~~

1. Section 1.3.8 for seismic resistance
2. Section 4.1.4 for determining the rehabilitation category of work
3. Section 4.7 for additions
4. Section 4.8 for alterations
5. Section 4.9 for change in occupancy

2018 International Building Code



American Concrete Institute
38800 Country Club Drive
Farmington Hills MI 48331

562-19: Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures

Commenter's Reason:

The Committee recommendation at the committee hearing was for disapproval because:

- 1) *Proposed reference standards, ACI Standard 562, is currently provided in draft format with additional changes anticipated, which are not currently available for review.* ACI 562-19 has been published and is an appropriate reference for the IEBC and compliant with Council Policy 28.
- 2) *Proposed language could create inconsistencies.* The language in the proposal identifying sections 1.3.8, 4.1.4, 4.7, 4.8 and 4.9 of ACI 562-19 are removed with this modification. ACI Committee 562 intentionally included the references back to the IEBC to ensure that determination of category of work be compliant with the IEBC.
- 3) *Proposed change would be hard to enforce and uses language such as 'shall be permitted'.* The revised language in this modification eliminates "shall be permitted". Section [A] 104.11 of the IEBC allows for alternative means and methods. Thus this proposal does not limit compliance to ACI 562.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptable criteria. In some conditions, the resulting determination is that the requirements for new construction are used in lieu of acceptable requirements for existing buildings. In other instances, repairs may be deficient with regards to structural performance or longevity.

Public Comment# 2009

Public Comment 2:

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Submitted

Commenter's Reason: At the Committee Action Hearings, there were three reasons given for recommending disapproval. The first is: "*Proposed reference standards, ACI Standard 562, is currently provided in draft format with additional changes anticipated, which are not currently available for review.*" ACI 562 *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures* was provided to committee member in a public discussion draft as required by ICC Council Policy 28. This was verified by staff during the hearings. Earlier editions have been published, are available, and have been used for the repair of structural concrete. The final published edition of ACI 562-19 is now available. The second reason was that "*Proposed language could create inconsistencies.*" The code change proposal was specifically written with guidance from the Applied Technology Council to provide exceptions that could be construed as circular references.

The third reason was: "*Proposed change would be hard to enforce and uses language such as 'shall be permitted.'*" The phrase is common language in the model codes and is thus not an appropriate reason to reject the adoption of ACI 562 as a permissible reference standard. The phrase is used 71 times in the 2018 edition of the IEBC and 532 times in the 2018 edition of the IBC in various Chapters as follows:

IEBC		IBC			
Chapter	Occurrences	Chapter	Occurrences	Chapter	Occurrences
1	2	1	2	18	153

2	0	2	0	19	2
3	7	3	1	20	0
4	5	4	56	21	4
5	16	5	16	22	6
6	0	6	12	23	31
7	5	7	113	24	6
8	14	8	14	25	2
9	5	9	25	26	19
10	11	10	71	27	0
11	0	11	16	28	0
12	4	12	7	29	2
13	1	13	0	30	8
14	0	14	14	31	6
15	1	15	29	32	0
16	0	16	16	33	2
17	0	17	1		

Testimony against focused on the standard development process. The process used is compliant with ICC Council Policy 28 as it is an American National Standards Institute accredited standards development process. Mention was made as to the number of comments submitted during the public review period. All comments submitted during this period were reviewed and acted upon in a manner consistent with the ANSI accredited process. ACI 562 is in its third edition, and like the model building codes being developed through this process, revisions are made in subsequent editions. New information must be properly vetted to assure a quality document. Further, there was mention of the volume of comments submitted in the public review period. Please consider that all consensus standards development processes a public comment period and from time to time individuals in opposition to the concept of standardization flood the committee during public comment periods with the intent of derailing or delaying development.

This document was developed by a committee of the American Concrete Institute which is a professional society dedicated to the development and adoption of documents that advance concrete technology and serve the public good. ACI, not being a trade or product association, does not campaign to promote the use of concrete in lieu of other building materials. ACI committees develop a variety of documents in the form of guides, reports, specifications, and code requirements. Over the past five decades, ACI Committee 562 and other related committees have generated numerous documents for use as guides and resources for the repair of structural concrete. Recognizing that even with the availability of these guides and resources nearly 50% of all repairs fail in less than 20 years, the committee determined that guidance and resources are not sufficient for the purposes of providing for the public good. The result has been committee work that produced building code requirements specifically addressing the evaluation, repair and rehabilitation of structural concrete.

Rationale for referencing ACI 562 in the IEBC was provided in testimony from design professionals, materials suppliers, building owners and managers, code officials, and contractors. The compelling testimony which may be viewed on the ICC website emphasized that: ACI 562 serves the public by providing the designer, owner, contractor, materials providers, and building code officials:

- A level of expectation of life safety to the public in buildings where repairs or rehabilitation is Performed on concrete structural elements;
- Clearly defined, uniform requirements aimed at extending the service life of existing structures;
- Minimum requirements for efficiency, safety, and quality of concrete repair;
- Clear communication of responsibilities between owners, designers, and contractors;
- Means for building code officials to evaluate rehabilitation designs;
- Specific repair requirements that often result in less costly repairs compared to requiring compliance with provisions for new construction requirements; and
- Increased confidence in performance of repairs that support the more sustainable approach compared to demolish and rebuild.

ACI recommends approval as submitted.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

For reasons stated in the cost impact provided with the original proposal, the proposal will not increase, but may often decrease the cost of construction.

Public Comment# 1342

EB17-19

IEBC@: CHAPTER 3, SECTION 301, 301.1, SECTION 302, 302.1, SECTION 503, 503.1

Proposed Change as Submitted

Proponents: Gina Hilberry, Scoping Task Group of ICC/A117.1 Standard Development Committee, representing United Cerebral Palsy (gina@cohenhilberry.com); Rick Lupton, representing Self (sparkylupton@msn.com); Marsha Mazz, representing United Spinal Association (m.mazz@verizon.net); Gene Boecker, representing Code Consultants, Inc.(geneb@codeconsultants.com)

2018 International Existing Building Code

CHAPTER 3 PROVISIONS FOR ALL COMPLIANCE METHODS

Revise as follows:

SECTION 301 ADMINISTRATION SCOPE

301.1 General. Applicability ~~The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with Section 301.2, 301.3, or 301.4. The provisions of Sections 302 through 305 shall apply to all alterations, repairs, additions, relocation of structures and changes of occupancy regardless of compliance method.~~

SECTION 302 GENERAL PROVISIONS

Delete without substitution:

~~**302.1 Applicability.** The provisions of Section 302 apply to all alterations, repairs, additions, relocations of structures and changes of occupancy regardless of compliance method.~~

SECTION 503 ALTERATIONS

Revise as follows:

~~**503.1 General.** Except as provided by Section 302.4, 302.5 or this section, alterations~~ Alterations to any building or structure shall comply with the requirements of the International Building Code for new construction. *Alterations* shall be such that the *existing building* or structure is not less complying with the provisions of the International Building Code than the *existing building* or structure was prior to the *alteration*.

Exceptions:

1. An existing stairway shall not be required to comply with the requirements of Section 1011 of the International Building Code where the existing space and construction does not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with Section 1011.11 of the International Building Code shall not be required to comply with the requirements of Section 1014.6 of the International Building Code regarding full extension of the handrails where such extensions would be hazardous because of plan configuration.
3. Where provided in below-grade transportation stations, existing and new escalators shall have a clear width of less than 32 inches (815 mm).

Reason: An intent of the IEBC changes creating the 2018 edition was to make the provisions of Chapter 3 applicable to all existing building work regardless of the compliance method chosen. Our group's concern was that the route a code user must follow to get to requirements of Section 305 was unclear. Section 305 contains provisions which are 'exceptions' from compliance with the IBC and the ICC A117.1 standard; thus the text of 503.1 is incomplete because it doesn't like you to exceptions in Section 305. Section 305 is similar to 302.4 and 302.5 in that something less than full compliance with IBC is allowed. We noticed that the other compliance methods had no link within them to Chapter 3.

The real problem, and the solution, is in the beginning of Chapter 3 where it fails to clearly state its purpose except in the title to the chapter. Titles are not code. It is essential that Section 301.1 state that Chapter 3 applies to all compliance methods as the title states.

We further noticed that 302.1 had such language covering Section 302 – but the rest of the chapter has no such statement. This proposal fixes it. Once stated in Section 301.1, it isn't needed in 302. Once stated in 301, exceptions aren't needed in 503 or in any of the other compliance methods. We also recommend the title of 301 be changed to either Scope or Applicability. Administration is something for Chapter 1 and not appropriate here.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The change provides an editorial correction to make sure the user understands that Section 305 also allows construction of alterations to a different and lesser technical requirement. And to make sure that the text of the Chapter is corrected to reflect the title – provisions for All Compliance Methods.

EB17-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The current language will get the code user to the correct sections but these revisions makes the links to the appropriate sections much cleaner. The provisions in Chapter 3 are intended to address all compliance methods. (Vote: 10-3)

Assembly Action:

None

EB17-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 301.1

Proponents:

Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

301.1 Applicability The *repair, alteration, change of occupancy, addition* or relocation of all *existing buildings* shall comply with Section 301.2, 301.3, or 301.4. The provisions of Sections 302, ~~304 and through~~ 305 shall apply to all alterations, repairs, additions, relocation of structures and changes of occupancy regardless of compliance method. The provisions of Section 303 shall apply where specifically required by other provisions of this code.

Commenter's Reason: The submitted code change proposal implies that the provisions of Section 303 are applicable to any alteration, addition or repair. That is not correct. Section 303 is only applicable when specifically triggered by other sections of the IEBC. The proposed language clarifies the intended use.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Both the original code change proposal and the public comment are clarifying already existing code language, and as a result do not have an impact on cost of construction.

Public Comment# 1463

EB20-19

IEBC@: SECTION 305, 305.6, 305.6.1, 305.6.2 (New), 305.6.3 (New), 305.6.4 (New), 305.6.5 (New), 305.8, 305.6.6, 305.6.7, 305.6.8, 305.6.9, 305.6.10, TABLE 305.6.10, 305.6.11 (New), 305.6.11.1, 305.6.11.2, 305.6.11.3, 305.6.12, 305.6.13, 305.6.14, 305.6.15, 305.6.16, 305.6.17, 305.6.18, 305.6.19, 305.6.19.1, 305.6.19.2, 305.6.19.3, 305.6.19.4

Proposed Change as Submitted

Proponents: Gina Hilberry, Scoping Task Group of ICC/A117.1 Standard Development Committee, representing United Cerebral Palsy (gina@cohenhilberry.com); Rick Lupton, representing Self (sparkylupton@msn.com); Marsha Mazz, representing United Spinal Association (m.mazz@verizon.net); Gene Boecker, representing Code Consultants, Inc.(geneb@codeconsultants.com)

2018 International Existing Building Code

SECTION 305 ACCESSIBILITY FOR EXISTING BUILDINGS

Revise as follows:

305.6 Alterations. A facility that is altered shall comply with the applicable provisions in Chapter 11 of the International Building Code, ICC A117.1 and the provisions of Sections 305.6.1 through 305.6.19, unless *technically infeasible*. Where compliance with this section is *technically infeasible*, the alteration shall provide access to the maximum extent technically feasible.

Exceptions:

- ~~1.The altered element or space is not required to be on an accessible route, unless required by Section 305.7.~~
- ~~2.Accessible means of egress required by Chapter 10 of the International Building Code are not required to be provided in existing facilities.~~
- ~~3.The alteration to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.~~
- ~~4.Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in existing buildings and facilities undergoing alterations where the work area is 50 percent or less of the aggregate area of the building.~~

~~**305.7 305.6.1 Alterations affecting an area containing a primary function.** Where an alteration affects the accessibility to, or contains an area of primary function, the route to the primary function area shall be accessible. The accessible route to the primary function area shall include toilet facilities and drinking fountains serving the area of primary function.~~

Exceptions:

- ~~1. The costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of primary function.~~
- ~~2. This provision does not apply to alterations limited solely to windows, hardware, operating controls, electrical outlets and signs.~~
- ~~3. This provision does not apply to alterations limited solely to mechanical systems, electrical systems, installation or alteration of fire protection systems and abatement of hazardous materials.~~
- ~~4. This provision does not apply to alterations undertaken for the primary purpose of increasing the accessibility of a facility.~~
- ~~5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.~~

Add new text as follows:

~~**305.6.2 Accessible route.** The altered element or space is not required to be on an accessible route, unless required by Section 305.6.1.~~

~~**305.6.3 Accessible means of egress** Accessible means of egress required by Chapter 10 of the International Building Code are not required to be provided in existing facilities.~~

~~**305.6.4 Alteration of Type A units** The alteration to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.~~

~~**305.6.5 Type B units** Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in existing buildings and facilities undergoing alterations where the work area is 50 percent or less of the aggregate area of the building.~~

Delete without substitution:

~~**305.8 Scoping for alterations.** The provisions of Sections 305.8.1 through 305.8.15 shall apply to alterations to existing buildings and facilities.~~

Revise as follows:

~~**305.8.1 305.6.6 Entrances.** Where an alteration includes alterations to an entrance that is not accessible, and the facility has an accessible~~

entrance, the altered entrance is not required to be *accessible* unless required by Section ~~305.7-~~305.6.1. Signs complying with Section 1111 of the International Building Code shall be provided.

~~305.8.2~~ 305.6.7 **Elevators.** Altered elements of existing elevators shall comply with ASME A17.1 and ICC A117.1. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

~~305.8.3~~ 305.6.8 **Platform lifts.** Platform (wheelchair) lifts complying with ICC A117.1 and installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

~~305.8.4~~ 305.6.9 **Stairways and escalators in existing buildings.** Where an escalator or stairway is added where none existed previously and major structural modifications are necessary for installation, an accessible route shall be provided between the levels served by the escalator or stairways in accordance with Section 1104.4 of the International Building Code.

~~305.8.5~~ 305.6.10 **Ramps.** Where slopes steeper than allowed by Section 1012.2 of the International Building Code are necessitated by space limitations, the slope of ramps in or providing access to existing facilities shall comply with Table ~~305.8.5-~~305.6.10.

**TABLE ~~305.8.5~~ 305.6.10
RAMPS**

SLOPE	MAXIMUM RISE
Steeper than 1:10 but not steeper than 1:8	3 inches
Steeper than 1:12 but not steeper than 1:10	6 inches

For SI: 1 inch = 25.4 mm.

Add new text as follows:

305.6.11 Determination of number of units Where Chapter 11 of the International Building Code requires Accessible, Type A or Type B units, where units are being altered or added, the number of Accessible, Type A and Type B units shall be determined in accordance with Sections 305.6.11.1 through 305.6.11.3.

Revise as follows:

~~305.8.6~~ 305.6.11.1 Accessible dwelling or sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added, the requirements of Section 1107 of the International Building Code for Accessible units apply only to the quantity of spaces being altered or added.

~~305.8.7~~ 305.6.11.2 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being altered or added, the requirements of Section 1107 of the International Building Code for Type A units apply only to the quantity of the spaces being altered or added.

~~305.8.8~~ 305.6.11.3 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements of Section 1107 of the International Building Code for Type B units apply only to the quantity of the spaces being added. Where Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered and where the *work area* is greater than 50 percent of the aggregate area of the building, the requirements of Section 1107 of the International Building Code for Type B units apply only to the quantity of the spaces being altered.

~~305.8.9~~ 305.6.12 Jury boxes and witness stands. In *alterations*, accessible wheelchair spaces are not required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where the ramp or lift access restricts or projects into the required means of egress.

~~305.8.10~~ 305.6.13 Toilet rooms. Where it is *technically infeasible* to alter existing toilet and bathing rooms to be *accessible*, an *accessible* family or assisted-use toilet or bathing room constructed in accordance with Section 1109.2.1 of the International Building Code is permitted. The family or assisted-use toilet or bathing room shall be located on the same floor and in the same area as the existing toilet or bathing rooms. At the inaccessible toilet and bathing rooms, directional signs indicating the location of the nearest family or assisted-use toilet room or bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

~~305.8.11~~ 305.6.14 Additional toilet and bathing facilities. In assembly and mercantile occupancies, where additional toilet fixtures are added, not fewer than one accessible family or assisted-use toilet room shall be provided where required by Section 1109.2.1 of the International Building Code. In recreational facilities, where additional bathing rooms are being added, not fewer than one family or assisted-use bathing room shall be provided where required by Section 1109.2.1 of the International Building Code.

~~305.8.12~~ 305.6.15 Dressing, fitting and locker rooms. Where it is *technically infeasible* to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level shall be provided. Where separate-sex facilities are provided, accessible rooms for each sex shall be provided. Separate-sex facilities are not required where only unisex rooms are provided.

~~305.8.13~~ 305.6.16 Fuel dispensers. Operable parts of replacement fuel dispensers shall be permitted to be 54 inches (1370 mm) maximum, measuring from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

~~305.8.14~~ 305.6.17 Thresholds. The maximum height of thresholds at doorways shall be ³/₄ inch (19.1 mm). Such thresholds shall have beveled edges on each side.

~~305.8.15~~ 305.6.18 Amusement rides. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with requirements for new construction in Section 1110.4.8 of the International Building Code.

~~305.9~~ 305.6.19 Historic buildings. These provisions shall apply to *facilities* designated as historic structures that undergo *alterations* or a *change of occupancy*, unless *technically infeasible*. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the *facility*, as determined by the authority having jurisdiction, the alternative requirements of Sections ~~305.9.1~~ 305.6.19.1 through ~~305.9.4~~ 305.6.19.4 for that element shall be permitted.

Exception: Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in

historic buildings.

~~305.9.1~~ **305.6.19.1 Site arrival points.** Not fewer than one accessible route from a site arrival point to an accessible entrance shall be provided.

~~305.9.2~~ **305.6.19.2 Multiple-level buildings and facilities.** An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

~~305.9.3~~ **305.6.19.3 Entrances.** Not fewer than one main entrance shall be accessible.

Exception: If a public entrance cannot be made accessible, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with Section 1111 of the International Building Code shall be provided at the public entrance and the accessible entrance.

~~305.9.4~~ **305.6.19.4 Toilet and bathing facilities.** Where toilet rooms are provided, not fewer than one accessible family or assisted-use toilet room complying with Section 1109.2.1 of the International Building Code shall be provided.

Reason: Sections 305.6 through 305.9 all address alterations but there is no connection between the sections. This is a problem when trying to determine the purpose of 305.8. Section 305.8 is titled 'Scoping for alterations', however many of the 15 provisions which follow are technical exceptions. Some of them are additional technical requirements. Eleven of the 15 are only found in the IEBC and four of them duplicate exceptions contained in the ICC A117.1 standard. Three of the 15 are telling the user how to calculate a requirement where not all units need to be accessible. The intent of this proposal is editorial. It is simply to provide connections between all of the Sections of 305 specifically addressing alterations. Substantive changes to these sections are found in companion proposals. This proposal does the following.

- It renumbers Section 305.7 to 305.6.1 to indicate that it is a subset set of the alterations section. There is a companion proposal to revise the language of 305.6.1 to be more consistent with the corresponding ADA requirement.
- It changes the 4 exceptions now found in Section 305.6 into the next four subsections – 305.6.2 through 305.6.5. Having titled subsections allow for quicker access for code users than sorting through numbered exceptions.
- It deletes the confusing lead in provisions of 305.8 and relocates its various provisions as the next subsections – 305.6.6 through 305.6.18. We have submitted a companion proposal which would delete four of these 9 because they are redundant with exceptions in the ICC A117.1 standard.
- It renumbers Section 305.9 and its subsections to be 305.6.19 because it contains a set of provisions and exceptions unique to historic buildings.
- Finally, it groups 3 provisions into a new subsection 305.6.11 All 3 of these sections provide a calculation methodology for determining the number of required dwelling and/or sleeping units

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The intent of this proposal is to be 100% editorial by reorganizing existing provisions into a more logical format.

EB20-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal provides a better structure and format of the provisions by pulling requirements out of an exception and providing better lead in language to the allowances or requirements as applicable. (Vote: 13-0)

Assembly Action:

None

EB20-19

Individual Consideration Agenda

Public Comment 1:

IEBC®: 305.6

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

305.6 Alterations. A *facility* that is altered shall comply with the applicable provisions in Chapter 11 of the International Building Code, ICC A117.1 and where specifically permitted by the provisions of Sections 305.6.1 through 305.6.19, unless *technically infeasible*. Where compliance with this section is *technically infeasible*, the *alteration* shall provide access to the maximum extent technically feasible.

Commenter's Reason: I was the proponent for EB 19, which was a similar attempt to clean up the accessibility provisions. I like how the proponents of this code change cleaned up these provisions but there's still a small tweak needed. By adding this additional code language, I think this change overall clearly identifies how accessibility provisions are to be applied within the IEBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost associated with this code change as it's cleaning up current code language for clarification.

Public Comment# 1599

EB25-19

IEBC@: 305.4 (New), 305.4.1 (New), 305.4.2 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

Revise as follows:

305.4 Change of occupancy. Existing buildings that undergo a change of group or occupancy shall comply with this ~~section~~, Sections 305.6, 305.7 and 305.8.

Exception: Type B dwelling or sleeping units required by Section 1107 of the International Building Code are not required to be provided in existing buildings and facilities undergoing a *change of occupancy* in conjunction with *alterations* where the *work area* is 50 percent or less of the aggregate area of the building.

Delete without substitution:

~~**305.4.1 Partial change of occupancy.** Where a portion of the building is changed to a new occupancy classification, any *alterations* shall comply with Sections 305.6, 305.7 and 305.8.~~

~~**305.4.2 Complete change of occupancy.** Where an entire building undergoes a *change of occupancy*, it shall comply with Section 305.4.1 and shall have all of the following accessible features:~~

- ~~1. Not fewer than one accessible building entrance.~~
- ~~2. Not fewer than one accessible route from an accessible building entrance to *primary function areas*.~~
- ~~3. Signage complying with Section 1111 of the International Building Code.~~
- ~~4. Accessible parking, where parking is being provided.~~
- ~~5. Not fewer than one accessible passenger loading zone, where loading zones are provided.~~
- ~~6. Not fewer than one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.~~

~~Where it is *technically infeasible* to comply with the new construction standards for any of these requirements for a change of group or occupancy, items 1 through 6 shall conform to the requirements to the maximum extent technically feasible.~~

~~**Exception:** The accessible features listed in Items 1 through 6 are not required for an accessible route to Type B units.~~

Reason: There are several arguments to simplify this section.

What this does administratively is take a change of occupancy and make it consistent with requirements for an alteration. This allows flexibility for small properties.

- The federal requirements in the 2010 ADA Standard do not address a change of occupancy – they treat all alterations the same. There is no justification for ICC to require a business in stand alone building to provide additional requirements past what is expected for a business in a multi-tenant building.
- The list in Section 305.4.2 basically lists all the elements in accessible routes, which is addressed in Section 305.7, but does not include bathrooms and drinking fountains. Therefore, it is unclear as to if renovations to those items are required in a complete change of occupancy, where they would be on the list for an alteration and a partial change of occupancy. This list does not add any clarification of improvements to the code.
- This could also be read that a complete change of occupancy would never have to fix the toilet rooms or drinking fountains since it is not in the list. If the alterations are small, allowing someone to spend money to fix the toilet rooms is addressed the needs of many individuals with mobility issue.
- If the part of the route missing is an elevator or extensive front ramp, the cost could make the existing building remain vacant since this section could be viewed as not tied to the 20% maximum cost allowance.
- The arguments against revising this section in past code cycles have all been around the issue of a change of occupancy with no alterations. Many building departments are not involved in changes of occupancy that do not include alterations. Even in jurisdictions that look at this, they do not require alterations for occupancies with lesser hazards. How much should you ask someone to spend if there are no construction costs? If it is a higher hazard, there will mostly likely be alterations – so just use those requirements.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will decrease the cost of construction

Requiring the six route requirements in Section 305.4.2 for small buildings that undergo a change of occupancy can be a large cost. It is more appropriate to limit the cost of the route to 20% of the alteration - which this change will allow. In large buildings, this change will have minimal impact since they are more likely to already have the accessible route - or the cost will be a much smaller portion of their budget.

EB25-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal was approved as change of occupancy is not addressed by the federal regulations. It was felt that the 20% requirement will address accessibility needs. The references to Section 305.6, 305.7 and 305.8 will address the needs for accessibility in existing buildings. (Vote: 13-0)

Assembly Action:

None

EB25-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Gregory Nicholls, representing American Institute of Architects (gnicholls@preview-group.com)

requests Disapprove

Commenter's Reason: The reason statement from the proponent is correct in stating that a change of occupancy is not addressed in the ADA Standard. That is because the DOJ regulations don't contain anything parallel to the building code's concept of change of occupancy, and don't have any occupancy classifications to start with. The only basis for working with existing buildings in the ADA Standard is when physical changes are proposed, as that is their only defined threshold.

One issue is consistency. The building codes of the ICC have always taken change of occupancy into account for egress, energy, fire safety and existing buildings. It would be unfair for a new small office building to have to provide an accessible entrance while changing from a building with no requirements for accessibility, a single family dwelling, to an office without alterations would require absolutely nothing. The proponent says the current code may be onerous, but has not attempted a compromise. Instead, accessibility for the mobility impaired to at least enter the building has been proposed to be eliminated. This is unfair to the disabled.

Another issue with this code change is that the ICC codes have been leaders and not followers on scoping for accessibility. The IBC and IEBC include private clubs, churches and multi-family dwellings that ADA and FHAG have not. Why retreat to a position of no inclusion?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2042

EB29-19

IEBC@: 305.7

Proposed Change as Submitted

Proponents: Gina Hilberry, Scoping Task Group of ICC/A117.1 Standard Development Committee, representing United Cerebral Palsy (gina@cohenhilberry.com); Rick Lupton, representing Self (sparkylupton@msn.com); Marsha Mazz, representing United Spinal Association (m.mazz@verizon.net); Gene Boecker, representing Code Consultants, Inc.(geneb@codeconsultants.com)

2018 International Existing Building Code

Revise as follows:

305.7 Alterations affecting an area containing a primary function. Where an *alteration* affects the accessibility to, or contains an area of *primary function*, ~~the route~~ an accessible path of travel to the *primary function* area shall be ~~accessible~~ provided. The accessible ~~route~~ path of travel to the *primary function* area shall include the accessible route, toilet facilities and drinking fountains serving the area of *primary function*.

Exceptions:

1. The costs of providing the ~~accessible route~~ path of travel are not required to exceed 20 percent of the costs of the *alterations* affecting the area of *primary function*.
2. ~~This provision~~ The requirement to provide an accessible path of travel does not apply ~~to alterations~~ where alterations within the primary function area are limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. ~~This provision does not apply to alterations limited solely to , signs,~~ mechanical systems, electrical systems, installation or alteration of fire protection systems and abatement of hazardous materials.
4. This provision does not apply to *alterations* undertaken for the primary purpose of increasing the accessibility of a *facility*.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

Reason: The IEBC code is unclear with respect to this requirement which derives from the ADA. The term used in the ADA is 'path of travel'. In the ADA it includes the accessible route to the primary function area as well as the telephones, toilet facilities and drinking fountains which serve the area of primary function. Saying 'accessible route' as it does in exception 1 is misleading. Path of travel could be defined in Chapter 2, but the last sentence of 305.7 is essentially the definition. As the term is not used elsewhere in the code, a chapter 2 definition seems unnecessary. Telephones are not included in the IEBC text because they are not typically part of the building regulated by the local building official. Telephone requirements for new construction are in Appendix E of the IBC.

Exception 3 is merged into exception 2 as they are both simply lists of elements exempt from the path of travel requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is primarily an editorial clarification of an existing requirement.

EB29-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There was support for the concept provided in this proposal to correlate language however the revisions as presented need more clarification as the terms may cause confusion with other terms used for means of egress in the I-Codes. (Vote: 10-3)

Assembly Action:

None

EB29-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Gene Boecker, representing Code Consultants, Inc.; Gina Hilberry, representing Scoping Task Group of ICC/A117.1 Standard Development Committee, representing United Cerebral Palsy (gina@cohenhilberry.com); Rick Lupton, representing Self (sparkylupton@msn.com); Marsha

Mazz, representing United Spinal Association (m.mazz@verizon.net)

requests As Submitted

Commenter's Reason: Although there were a few on the committee who agreed with the proposal, the committee did not understand and voted wrong.

There are several reasons why the committee's vote should be overturned in favor of As Submitted.

1. The code has always tended to use the terminology that is used by the industry which it is addressing in the code text. The accessibility industry (the users, consultants, and enforcers; including the U.S. Department of Justice) uses the term "Path of Travel" when describing the mandated renovation work that includes the area outside the initial area of alteration. To be consistent with the industry usage, the code language should be changed.

2. The committee expressed concern that the change would lead to confusion in the use of the three words. A search of the expression yielded the following ten results. All are within the IBC. The term does not exist within the IEBC except in the proposed code change. The chances of getting the text confused based on the number of occurrences is extremely low.

- DIRECT ACCESS. A path of travel from a space to an immediately adjacent space through an opening in the common wall between the two spaces.
- 410.5.3.3 Two means of egress. Where two means of egress are required, the common path of travel shall be not greater than 100 feet (30 480 mm).
- 1008.2.3 Exit discharge. Illumination shall be provided along the path of travel for the exit discharge from each exit to the public way.
- 1028.1, exceptions 1.1. Discharge of interior exit stairways and ramps shall be provided with a free and unobstructed path of travel to an exterior exit door and such exit is readily visible and identifiable from the point of termination of the enclosure.
- 1028.5, exception 4. The area shall be provided with a safe and unobstructed path of travel from the building.
- 1029.4 Foyers and lobbies. In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available, such persons shall be allowed to wait in a lobby or similar space, provided that such lobby or similar space shall not encroach on the minimum width or required capacity of the means of egress. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.
- 2902.3.23 Location of toilet facilities in occupancies other than malls. In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).
- 2902.3.34 Location of toilet facilities in malls. In covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet....
- 3007.6.1 Access to interior exit stairway or ramp. The enclosed fire service access elevator lobby shall have direct access from the enclosed elevator lobby to an enclosure for an interior exit stairway or ramp.
 - Exception: Access to an interior exit stairway or ramp shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.5.32.2.1.
- 3008.6.1 Access to interior exit stairway or ramp. The occupant evacuation elevator lobby shall have direct access from the enclosed elevator lobby to an interior exit stairway or ramp.
 - Exceptions: 1. Access to an interior exit stairway or ramp shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure.

3. Additionally, the term as intended within the IEBC is prefaced with the word "accessible" in all occurrences, further identifying this as a unique situation.

4. The accessible path of travel includes other elements. It is the overarching "thing" that addresses what is included in the renovation work. The current text uses the term "accessible route" which is only a part of the accessible path of travel. It then has to add in the other items. The proposed text makes it much simpler and is consistent with its use in the federal ADA standards.

This proposal is brought to you by experts in the accessibility industry - people who use the IBC, the IEBC and the ADA Standards. Please overturn the committee and make the IEBC consistent with the terminology used throughout the country for this concept.

Bibliography: U.S. 2010 ADA Standards for Accessible Design; Section 202.4 and the Advisory to Section 202.4.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As stated in the original proposal, there is no change in the cost of construction.

Public Comment# 1862

EB35-19

IEBC@: 305.8.6 (New)

Proposed Change as Submitted

Proponents: Ronald Clements Jr, representing VBCOA (clementsro@chesterfield.gov)

2018 International Existing Building Code

Add new text as follows:

305.8.6 Dining areas. An accessible route is not required to raised or sunken dining areas or outdoor dining areas where accessible dining areas with the same services are provided on the same floor level.

Reason: This provision for dining areas was in the work area method going back to the first edition. It was not in the prescriptive method when that method was introduced in the 2006 edition. When the accessibility provisions were consolidated in chapter 3 the dining area provision was lost; it was section 705.1.5 in the 2015 edition. It appears the loss was not intentional.

Cost Impact: The code change proposal will decrease the cost of construction. This provides another option that could decrease construction cost.

EB35-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This exception for dining areas was not seen as reasonable and can be addressed as a technical feasibility issue. It was noted that this section was purposely removed for the 2018 IEBC. (Vote: 13-0)

Assembly Action:

None

EB35-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 305.8.6 (New)

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

305.8.6 Dining areas. An accessible route shall be provided throughout the dining area.

Exception: An accessible route is not required to raised or sunken dining areas or outdoor dining areas where accessible dining areas with the same services are provided on the same floor level.

Commenter's Reason: As written, the original code change is writing an exception as code language. That's not how any of the I Codes are intended to be formatted. This public comment corrects the code language so that the exception is now in the correct location.

The committee noted that the removal of this language from the 2018 IEBC was intentional and that this can be addressed as a technical feasibility

issue. Some jurisdictions that adopt the IEBC may not see this issue as such and would require this, thus the language should be provided for in the IEBC to clearly define the intention.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

Per the original proponent, this provides another option that could decrease construction cost. The overall change may not affect construction costs at all.

Public Comment# 1596

EB38-19

IEBC@: SECTION 306 (New), 306.1 (New)

Proposed Change as Submitted

Proponents: Stephen Thomas, representing Himself (stthomas@coloradocode.net)

2018 International Existing Building Code

Add new text as follows:

SECTION 306 MEANS OF EGRESS FOR EXISTING BUILDINGS

306.1 Occupant Load based on Capacity Where approved by the code official, the occupant load of any room, areas, space or story shall be permitted to be established as the number of occupant for which the existing means of egress capacity is adequate. Measures shall be established to prevent occupancy greater than the number and capacity of the means of egress components. Such measures can include, but are not limited to the posting of the occupant load for the room, area, space or story.

Reason: Many shell and core buildings are constructed with the minimum means of egress capacity for the anticipated use. However, when the space is finished, the new use may have spaces with occupant loads higher than originally anticipated. Therefore, the existing egress capacity is not adequate enough for the new space. This proposal provides an option to base the occupant load on the existing capacity of the space. It requires the building official's approval to use this option to reduce possible abuse of the requirement.

For example, if a space has two 36-inch wide doors that provide 34-inches of egress capacity, the maximum occupant load permitted in that space would be 340. In some cases, it is either very expensive or impossible to add an additional means of egress or capacity. If the calculated occupant load was greater than the 340, the building official could approve the reduction of the occupant load to a maximum of 340. They would then determine how that occupant load would be maintained which could include the posting of the occupant load in the space. This happens in office tenant improvements quite often. The original building was designed with an occupant load calculation for business use, but the new tenant space has some assembly functions that increase the occupant load.

This proposal was submitted to the Means of Egress Committee in the Group A Cycle. They felt that the requirement would be better located in the IEBC. Their other concerns were addressed by some revisions to the original language submitted to them.

Cost Impact: The code change proposal will decrease the cost of construction
By allowing the occupant load to be based on the egress capacity, the cost of additional exits or capacity will be eliminated.

EB38-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal was disapproved. Although the challenge to address these situations exists the language needs further revision. It was generally felt that the language is unnecessary as the building official already has the authority to address these situations based upon the intent and purpose of the code. There was some opinion that this is a necessary tool and would provide necessary guidance. (Vote: 8-5)

Assembly Action:

None

EB38-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter (stthomas@coloradocode.net)

requests As Submitted

Commenter's Reason: There are many times where shell buildings are designed using the minimum occupant load for a building. Then, the tenant comes in and has different occupant loads than were originally used. If the means of egress was designed to the original occupant load, the new tenant has a problem with complying with Chapter 10 of the IBC. This proposal gives the building official the authority to use the actual capacity and number of exits to determine the total occupant load for a space or story. This is similar to the exception to IBC Section 1004.5, but is more specific to address the actual capacity of the means of egress to determine the occupant load. We feel that this provides the building official with additional tools to address alterations to a building in dealing with the means of egress. The building official does not have to approve the design if they are not comfortable with it. It is an option, not a requirement.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. By reducing the occupant load based on the capacity, additional exits or plumbing fixtures will not be required.

Public Comment# 1561

EB39-19

IEBC@: SECTION 306 (New), 306.1 (New), 306.1.1 (New), 306.1.2 (New)

Proposed Change as Submitted

Proponents: John Williams, representing Healthcare Committee (AHC@iccsafe.org)

2018 International Existing Building Code

Add new text as follows:

SECTION 306 HEALTHCARE

306.1 General. Healthcare facilities including Group I-2, ambulatory care facilities and outpatient clinics undergoing repair, alterations, additions and change of occupancy shall be in accordance with Sections 306.1.1 and 306.1.2, as applicable.

306.1.1 Existing construction requirements. Existing Group I-2 facilities shall meet the minimum construction requirements in Chapter 11 of the International Fire Code.

306.1.2 Projections in Nursing Home Corridors. In Group I-2, Condition 1 occupancies, where the corridor is at least 96 inches wide, projections into the corridor width are permitted in accordance with Section 407.4.3 of the International Building Code.

Reason: This proposal creates a section in chapter 3 for special requirements for healthcare facilities. Due to federal reimbursement requirements, there are specific existing building issues that must be mitigated before receiving federal funds. These are reflected in Chapter 13 of the IFC, however, not all jurisdictions adopt this chapter. By referencing those requirements in the IEBC, we provide facilities with a greater chance at maintaining federal certification and at the same time ensure basic safety provisions for facilities that house fragile populations.

A companion proposal directly references chapter 11 of the IFC in all of the compliance methods. If it is more effective to have the actual technical requirements in this document, this change creates a place for those requirements to live..

The intent of Section 306.2 is to correlate with the federal regulations and the allowances in the IBC for fixed furniture in corridors where special considerations are met.

This proposal is submitted by the ICC Committee on Healthcare (CHC). The CHC was established by the ICC Board to evaluate and assess contemporary code issues relating to healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2017 and 2018 the CHC held 4 open meetings and numerous conference calls, *which included members of the committees as well as any interested parties, to discuss and debate the proposed changes.* Information on the CHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CHC effort can be downloaded from the CHC website at: <https://www.iccsafe.org/codes-tech-support/cs/icc-committee-on-healthcare/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is a pointer to the IEBC that indicates the allowances permitted for fixed furniture.

EB39-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This new section was approved as it was felt to provide the necessary correlation with federal healthcare occupancy requirements. It was suggested that potentially Chapter 3 may need a section dealing with occupancy based provisions. (Vote: 13-0)

Assembly Action:

None

EB39-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests Disapprove

Commenter's Reason: ADM8-19 added the following text to IEBC Chapter 1:

"101.2.1 Application of fire code. Where work regulated by this code is also regulated by the construction requirements for existing buildings in Chapter 11 of the International Fire Code, such work shall comply with applicable requirements in both codes."

With this text providing a broad reference to IFC Chapter 11, individual pointed references spread throughout the IEBC are unnecessary, and there is an implication of ..."well, if only these sections are being referenced in a specific section of the code, is compliance with the rest of IFC Chapter 11 not necessary to these applications?" It is better to let the general reference in Chapter 1 prevail and not include partial/incomplete references on specific topics elsewhere in the code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No change to code.

Public Comment# 2027

EB40-19

IEBC@: SECTION 306 (New), 306.1 (New), SECTION 307 (New), 307.1 (New), 502.6, 502.7, 503.14, 503.15, 803.4.3, SECTION 804, 804.1, SECTION 1104, 1104.1, SECTION 1105, 1105.1

Proposed Change as Submitted

Proponents: Stephen Thomas, representing Himself (sthomas@coloradocode.net)

2018 International Existing Building Code

Add new text as follows:

SECTION 306 **SMOKE ALARMS**

306.1 Smoke Alarms Where an alteration, addition, change of occupancy or relocation of a building is made to an existing building or structure of a Group R and I-1 occupancies, the existing building shall be provided with smoke alarms in accordance with Section 1103.8 of the International Fire Code or Section R314 of the International Residential Code.

SECTION 307 **CARBON MONOXIDE DETECTION**

307.1 Carbon monoxide alarms. Where an addition, alteration, change of occupancy or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies, the existing building shall be provided with carbon monoxide alarms in accordance with Section 1103.9 of the International Fire Code or Section R315 of the the International Residential Code.

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.

Delete without substitution:

~~**502.6 Smoke alarms in existing portions of a building.** Where an addition is made to a building or structure of a Group R or I-1 occupancy, the existing building shall be provided with smoke alarms in accordance with Section 1103.8 of the International Fire Code.~~

~~**502.7 Carbon monoxide alarms in existing portions of a building.** Where an addition is made to a building or structure of Group I-1, I-2, I-4 or R occupancy, the existing building shall be provided with carbon monoxide alarms in accordance with Section 1103.9 of the International Fire Code or Section R315 of the International Residential Code, as applicable.~~

~~**Exceptions:**~~

- ~~1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.~~
- ~~2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.~~

~~**503.14 Smoke alarms.** Individual sleeping units and individual dwelling units in Group R and I-1 occupancies shall be provided with smoke alarms in accordance with Section 1103.8 of the International Fire Code.~~

~~**503.15 Carbon monoxide alarms.** Carbon monoxide alarms shall be provided to protect sleeping units and dwelling units in Group I-1, I-2, I-4 and R occupancies in accordance with Section 1103.9 of the International Fire Code.~~

~~**Exceptions:**~~

- ~~1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.~~
- ~~2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.~~

~~**803.4.3 Smoke alarms.** Individual sleeping units and individual dwelling units in any work area in Group R and I-1 occupancies shall be provided with smoke alarms in accordance with the International Fire Code.~~

~~**Exception:** Interconnection of smoke alarms outside of the work area shall not be required.~~

SECTION 804 **CARBON MONOXIDE DETECTION**

~~804.1 Carbon monoxide alarms. Any work area in Group I-1, I-2, I-4 and R occupancies shall be equipped with carbon monoxide alarms in accordance with Section 1103.9 of the International Fire Code.~~

Exceptions:

- ~~1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.~~
- ~~2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.~~

**SECTION 1104
SMOKE ALARMS IN OCCUPANCY
GROUPS R AND I-1**

~~1104.1 Smoke alarms in existing portions of a building. Where an addition is made to a building or structure of a Group R or I-1 occupancy, the existing building shall be provided with smoke alarms as required by Section 1103.8 of the International Fire Code or Section R314 of the International Residential Code as applicable.~~

**SECTION 1105
CARBON MONOXIDE ALARMS IN
GROUPS I-1, I-2, I-4 AND R**

~~1105.1 Carbon monoxide alarms in existing portions of a building. Where an addition is made to a building or structure of a Group I-1, I-2, I-4 or R occupancy, the existing building shall be equipped with carbon monoxide alarms in accordance with Section 1103.9 of the International Fire Code or Section R315 of the International Residential Code, as applicable.~~

Reason: Smoke alarms and carbon monoxide alarms are required for all the different options in the IEBC. It does not make sense to have the same requirements duplicated in the different options. Chapter 3 was created to address requirements that were applicable to all of the options. Therefore, this proposal places the requirement for smoke alarms and carbon monoxide alarms in Chapter 3 and deletes the specific requirements elsewhere in the code. This change also maintains the pointer to the fire code for these requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is just a relocation of the requirements into a single location.

EB40-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

~~307.1 Carbon monoxide alarms-detection. Where an addition, alteration, change of occupancy or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies, the existing building shall be provided with carbon monoxide ~~alarms-~~detection in accordance with Section 1103.9 of the International Fire Code or Section R315 of the the International Residential Code.~~

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.

Committee Reason: The committee agreed with moving the smoke alarms and carbon monoxide detection to Chapter 3 in an effort to simplify the application of requirements. There was a concern raised that we need to have an exception added during public comment for Alteration level 1 as these sections currently only apply to level 2 alterations. The modification aligns the language with what is proposed in EB52-19. These revisions align with actions taken on the IBC and IFC. (Vote:13-0)

Assembly Action:

None

EB40-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: SECTION 306 (New), 306.1 (New), SECTION 307 (New), 307.1 (New)

Proponents:

Ed Kulik, representing ICC (bcac@iccsafe.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

SECTION 306 SMOKE ALARMS

306.1 Smoke Alarms Where an alteration, addition, change of occupancy or relocation of a building is made to an existing building or structure of a Group R and I-1 occupancies, the existing building shall be provided with smoke alarms in accordance with Section ~~1103.8.2.10~~ of the International Fire Code or Section R314 of the International Residential Code.

Exception: Alterations and changes of occupancy shall be permitted to comply with the following:

1. Section 1103.8.2 of the International Fire Code for interconnection.
2. Section 1103.8.3 of the International Fire Code for power source

SECTION 307 CARBON MONOXIDE DETECTION

307.1 Carbon monoxide detection. Where an addition, alteration, change of occupancy or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies, the existing building shall be provided with carbon monoxide detection in accordance with Section ~~1103.9.915~~ of the International Fire Code or Section R315 of the the International Residential Code.

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.
3. For alterations and changes of occupancy the following shall apply:
 - 3.1. Carbon monoxide alarms are permitted to be solely battery operated where the code that was in effect at the time of construction did not require carbon monoxide detectors to be provided.
 - 3.2. Carbon monoxide alarms are permitted to be solely battery operated in dwelling units that are not served from a commercial power source.

Commenter's Reason: Code change proposal EB106-19 made a revision for additions related to smoke alarms and carbon monoxide detection that reference the new construction requirements in Chapter 9 of the IBC. EB40-19 moved all the requirements to one section in Chapter 3 for additions, alterations and change of occupancy. This public comment is combining those code change concepts to better understand how the revisions work together. This PC is necessary as additions are treated as new construction. Alterations and change of occupancy are afforded more flexibility therefore the exceptions allowed in Chapter 11 of the IFC are added for alterations and change of occupancy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The intent of the codes is that additions are treated as new construction and alterations and change of occupancy are considered existing and typically have more flexibility. This public comments is trying to make this intent clear therefore the application should be the same.

Public Comment 2:**IEBC@: 306.1 (New), 307.1 (New)****Proponents:**

Steve Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter (stthomas@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:**2018 International Existing Building Code**

306.1 Smoke Alarms Where an alteration, addition, change of occupancy or relocation of a building is made to an existing building or structure of a Group R and I-1 occupancies, the existing building shall be provided with smoke alarms in accordance with Section 1103.8 of the International Fire Code or Section R314 of the International Residential Code.

Exception: Work classified as Level 1 Alterations in accordance with Chapter 7.

307.1 Carbon monoxide detection. Where an addition, alteration, change of occupancy or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies, the existing building shall be provided with carbon monoxide detection in accordance with Section 1103.9 of the International Fire Code or Section R315 of the the International Residential Code.

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.
3. Work classified as Level 1 Alterations in accordance with Chapter 7.

Commenter's Reason: The committee pointed out that Level 1 Alterations did not require that smoke alarms or carbon monoxide detectors were required. We agree with the committee and requested that the committee approve the proposal as modified and promised to add the exceptions show in this proposed modification. This is intended to just clarify that the upgrades are not required when doing a Level 1 Alteration.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment is only meant as a clarification as to what the code currently requires so the cost of construction will not change.

EB41-19

IEBC: 401.1.1 (New), 401.1.2 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

Revise as follows:

SECTION 401 GENERAL

401.1 Scope. *Repairs* shall comply with the requirements of this chapter. *Repairs to historic buildings* need only comply with Chapter 12.

Add new text as follows:

401.1.1 Partial reconstruction. Where damage from fire, earthquake, storm or a similar event has rendered one or more stories of a building, structure or portion thereof as unsafe, reconstruction of such areas shall meet the requirements for a Level 2 or 3 alteration, as applicable.

401.1.2 Complete reconstruction. Where damage from fire, earthquake, storm or similar event has demolished the building structure, or a portion of a building or structure from the foundation to the roof, reconstruction of such areas shall be in accordance with the International Building Code.

Reason: There is a question as to when damage from a fire or other disaster destroying all or a good chunk of a building. Do you have to go back to IBC or can you build back the way it was? This concept is to try and separate repair from new construction requirements at a logical point. Note that this also helps people get the true value for reconstruction as the insurance industry may sometimes classify a new building (or a replacement of the large portion or an entire story) as a repair and funding is limited.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is intended as a clarification of requirements.

EB41-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The intent of what this is addressing is valid but some felt that the code already provides the necessary provisions to address these issues. Others felt that the concern was valid however the language needs to be cleaned up in particular when addressing partial reconstruction. There was a concern that without this proposal the definition of repair would allow buildings to be constructed as a repair when only the foundation remains. (Vote: 8-5)

Assembly Action:

None

EB41-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: SECTION 401 (New), 401.1 (New), 401.1.1 (New), 401.1.2 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

Modify as follows:

2018 International Existing Building Code

SECTION 401 GENERAL

401.1 Scope. *Repairs* shall comply with the requirements of this chapter. *Repairs to historic buildings* need only comply with Chapter 12.

401.1.1 Partial reconstruction. Where ~~a structure sustains substantial structural damage from fire, earthquake, storm or a similar event has rendered one or more stories of a building, structure or portion thereof as unsafe~~, reconstruction of such areas shall meet the requirements for a Level 2 or 3 alteration, as applicable.

401.1.2 Complete reconstruction. Where ~~damage from fire, earthquake, storm or similar event disaster has demolished the building~~ a structure is destroyed, or a portion of a building or structure from the foundation to the roof, reconstruction of such areas shall be in accordance with the International Building Code or the International Residential Code.

Commenter's Reason: The purpose of this public comment is to address the committee's concerns that more clarification was needed. New Section 401.1.1 requires that partial reconstruction also meet the requirements of a Level 2 alteration when substantial structural damage has occurred and the scope of reconstruction is consistent with the Section 603 description of Alteration – Level 2. Likewise, new Section 401.1.1 requires that partial reconstruction also meet the requirements of a Level 3 alteration when substantial structural damage has occurred and the scope of reconstruction is consistent with the Section 604 description of Alteration - Level 3. New Section 401.1.2 requires that complete reconstruction from the foundation up meet the requirements of the International Building Code or International Residential code when substantial structural damage has occurred

While Chapter 4 of the IEBC does has triggers for upgrading a building's structural system to current code based on the source and degree of damage, it is still possible under Chapter 4 for significant reconstruction to occur without upgrades to egress, fire protection, or MEP systems. By requiring that partial reconstruction also meet the requirements of a Level 2 alteration per Section 603 or Level 3 alteration per Section 604 based on the total scope and area of reconstruction, a more clear line can be drawn between when the reconstruction need only maintain the level of fire protection, egress, etc. that existed in the building at the time the damage occurred, versus when a sufficient portion of the building has been damaged that those portions should be reconstructed as a new building. Note based on the requirements of Level 2 and 3 alterations this may require upgrading building systems outside of the damaged area. The BCAC did revise the language of Section 401.1.1 to refer specifically to "significant structural damage", which is a defined term in the IEBC.

Section 401.1.2 has been revised to clarify the language and better draw the dividing line between a repair that need only maintain the existing level of protection and structural performance and a reconstruction that needs to meet the requirements of a new building. The BCAC determined the word "destroyed" was better than "demolished". A reference to the IRC is added for code users who opt to (or are required to by the jurisdiction) use the IEBC to direct existing work in an otherwise IRC-scope dwelling rather than deferring entirely to the IRC.

The BCAC also removed the laundry list of events that could cause damage to a building. This is consistent with a variety of IEBC definitions related to repair or to types of damage (e.g. substantial damage) that imply damage can be from any type of event that is no fault of the owner (i.e. not poor maintenance).

The defined terms are as follows:

[A] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

[BS] SUBSTANTIAL STRUCTURAL DAMAGE. A condition where any of the following apply:

1. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load carrying capacity of any story in any horizontal direction has been reduced by more than 33 percent from its predamage condition.
2. The capacity of any vertical component carrying gravity load, or any group of such components, that has a tributary area more than 30 percent of the total area of the structure's floor(s) and roof(s) has been reduced more than 20 percent from its predamage condition, and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by the International Building Code for new buildings of similar structure, purpose and location.
3. The capacity of any structural component carrying snow load, or any group of such components, that supports more than 30 percent of the roof area of similar construction has been reduced more than 20 percent from its predamage condition, and the remaining capacity with respect to dead, live and snow loads is less than 75 percent of that required by the International Building Code for new buildings of similar structure, purpose and location.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open

meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

By drawing a brighter line between when one can reconstruct to a pre-damage condition versus reconstructing as a new building, some buildings that may have been allowed to treat extensive reconstruction as a repair will now need to have egress, fire protection, or MEP systems upgraded as well as any triggered structural upgrades. The cost of the reconstruction would increase where the cost of compliance with new code provisions has increased. The benefit is an increase in safety and gain in community resilience as more of the existing building stock is upgraded.

Public Comment# 1176

EB47-19

IEBC@: 406.1.4 (New), 802.3 (New), 805.4.1.2 (New), 1301.6.4 (New), 1301.6.21 (New), 1301.6.21.1 (New), TABLE 1301.6.21.1 (New), 1301.6.21.1.1 (New), 1301.6.21.2 (New), TABLE 1301.6.21.2 (New), 1301.6.21.2.1 (New), 1301.6.21.3 (New), TABLE 1301.6.21.3 (New), 1301.6.21.3.1 (New), 1301.7 (New), TABLE 1301.7

Proposed Change as Submitted

Proponents: John Williams, representing Healthcare Committee (AHC@iccsafe.org)

2018 International Existing Building Code

Revise as follows:

406.1.4 Group I-2 receptacles. Receptacles in ~~patient-care recipient~~ bed locations of Group I-2 that are not “hospital grade” shall be replaced with “hospital grade” receptacles, as required by NFPA 99 and Article 517 of NFPA 70.

802.3 Smoke compartments. In Group I-2 occupancies where the *work area* is on a story used for sleeping rooms for more than 30 ~~patients-care recipients~~, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the International Building Code as required for new construction.

805.4.1.2 Group I-2. In buildings of Group I-2 occupancy, any ~~patient-care recipient~~ sleeping room or suite of ~~patient-care recipient~~ rooms greater than 1,000 square feet (93 m²) within the *work area* shall have not fewer than two egress doorways.

1301.6.4 Tenant and dwelling unit separations. Evaluate the fire-resistance rating of floors and walls separating tenants, including dwelling units, and not evaluated under Sections 1301.6.3 and 1301.6.5. Group I-2 occupancies shall evaluate the rating of the separations between ~~patient-care recipient~~ sleeping rooms.

Under the categories and occupancies in Table 1301.6.4, determine the appropriate value and enter that value in Table 1301.7 under Safety Parameter 1301.6.4, Tenant and Dwelling Unit Separation, for fire safety, means of egress, and general safety.

1301.6.21 ~~Patient-Care recipient~~ ability, concentration, smoke compartment location and ratio to attendant. In I-2 occupancies, the ability of ~~patients-care recipients~~, their concentration and ratio to attendants shall be evaluated and applied in accordance with this section. Evaluate each smoke compartment using the categories in Sections 1301.6.21.1, 1301.6.21.2 and 1301.6.21.3 and enter the value in Table 1301.7. To determine the safety factor, multiply the three values together; if the sum is 9 or greater, compliance has failed.

1301.6.21.1 ~~Patient-Care recipient~~ ability for self-preservation. Evaluate the ability of the ~~patients-care recipients~~ for self-preservation in each smoke compartment in an emergency. Under the categories and occupancies in Table 1301.6.21.1, determine the appropriate value and enter that value in Table 1301.7 under Safety Parameter 1301.6.21.1, ~~Patient-Care recipient~~ Ability for Self-preservation, for means of egress and general safety.

TABLE 1301.6.21.1
PATIENT-CARE RECIPIENT ABILITY VALUES

OCCUPANCY	CATEGORIES		
	a	b	c



1301.6.21.1.1 Categories. The categories for patient-care recipient ability for self-preservation are:

1. Category a—(mobile) Patients-Care recipients are capable of self-preservation without assistance.
2. Category b—(not mobile) Patients-Care recipients rely on assistance for evacuation or relocation.
3. Category c—(not movable) Patients-Care recipients cannot be evacuated or relocated.

1301.6.21.2 Patient-Care recipient concentration. Evaluate the concentration of patients in each smoke compartment under Section 1301.6.21.2. Under the categories and occupancies in Table 1301.6.21.2 determine the appropriate value and enter that value in Table 1301.7 under Safety Parameter 1301.6.21.2, Patient-Care Recipient Concentration, for means of egress and general safety.

TABLE 1301.6.21.2
PATIENT-CARE RECIPIENT CONCENTRATION VALUES

OCCUPANCY	CATEGORIES		
	a	b	c
I-2	1	2	3

1301.6.21.2.1 Categories: The categories for patient-care recipient concentration are:

1. Category a—smoke compartment has 1 to 10 patients-care recipients.
2. Category b—smoke compartment has more than 10 to 40 patients-care recipients.
3. Category c—smoke compartment has more than 40 patients-care recipients.

1301.6.21.3 ~~Attendant-to-patient~~ Attendant-to-care recipient ratio. Evaluate the ~~attendant-to-patient~~ attendant-to-care recipient ratio for each compartment under Section 1301.6.21.3. Under the categories and occupancies in Table 1301.6.21.3 determine the appropriate value and enter that value in Table 1301.7 under Safety Parameter 1301.6.21.3, ~~Attendant-to-patient~~ Attendant-to-care recipient Ratio, for means of egress and general safety.

TABLE 1301.6.21.3
~~ATTENDANT-TO-PATIENT~~ ATTENDANT-TO-CARE RECIPIENT RATIO VALUES

OCCUPANCY	CATEGORIES		
	a	b	c
I-2	1	2	3

1301.6.21.3.1 Categories. The categories for attendant-to-patient concentrations are:

1. Category ~~a—attendant-to-patient~~ a—attendant-to-care recipient concentration is 1:5.
2. Category ~~b—attendant-to-patient~~ b—attendant-to-care recipient concentration is 1:6 to 1:10.
3. Category ~~c—attendant-to-patient~~ c—attendant-to-care recipient concentration is greater than 1:10 or no patients.

1301.7 Building score. After determining the appropriate data from Section 1301.6, enter those data in Table 1301.7 and total the building score.

**TABLE 1301.7
SUMMARY SHEET—BUILDING CODE**

Existing occupancy: _____		Proposed occupancy: _____	
Year building was constructed: _____		Number of stories: _____ Height in feet: _____	
Type of construction: _____		Area per floor: _____	
Percentage of open perimeter increase: _____ %			
Completely suppressed:	Yes _____ No _____	Corridor wall rating: _____	
		Type: _____	
Compartmentation:	Yes _____ No _____	Required door closers:	Yes _____ No _____
Fire-resistance rating of vertical opening enclosures: _____			
Type of HVAC system: _____, serving number of floors: _____			
Automatic fire detection:	Yes _____ No _____	Type and location: _____	
Fire alarm system:	Yes _____ No _____	Type: _____	
Smoke control:	Yes _____ No _____	Type: _____	
Adequate exit routes:	Yes _____ No _____	Dead ends: _____	Yes _____ No _____
Maximum exit access travel distance: _____		Elevator controls:	Yes _____ No _____
Means of egress emergency lighting:	Yes _____ No _____	Mixed occupancies:	Yes _____ No _____
Standpipes:	Yes _____ No _____	Patient-C are recipient ability for self-preservation: _____	
Incidental use:	Yes _____ No _____	Patient C are recipient concentration: _____	
Smoke compartmentation less than 22,500 sq. feet (2092 m ²):	Yes _____ No _____	Attendant-to-patient care recipient ratio: _____	
SAFETY PARAMETERS		FIRE SAFETY (FS)	MEANS OF EGRESS (ME)
1301.6.1 Building height			
1301.6.2 Building area			
1301.6.3 Compartmentation			
1301.6.4 Tenant and dwelling unit separations			
1301.6.5 Corridor walls			
1301.6.6 Vertical openings			
1301.6.7 HVAC systems			
1301.6.8 Automatic fire detection			
1301.6.9 Fire alarm system			
1301.6.10 Smoke control		****	
1301.6.11 Means of egress		****	
1301.6.12 Dead ends		****	
1301.6.13 Maximum exit access travel distance		****	
1301.6.14 Elevator control			
1301.6.15 Means of egress emergency lighting		****	
1301.6.16 Mixed occupancies			****
1301.6.17 Automatic sprinklers			÷ 2 =
1301.6.18 Standpipes			

1301.6.19 Incidental use			
1301.6.20 Smoke compartmentation			
1301.6.21.1 Patient <u>Care recipient</u> ability for self-preservation ^a	****		
1301.6.21.2 Patient <u>Care recipient</u> concentration ^a	****		
1301.6.21.3 Attendant-to- patient <u>care recipient</u> ratio ^a	****		
Building score—total value			

****No applicable value to be inserted.

a. Only applicable to Group I-2 occupancies.

Reason:

The purpose of this proposal is to coordinate the terminology for healthcare in the IBC and IFC with the IEBC. Care recipient is more appropriate when speaking about the persons receiving care in nursing homes and hospitals.

This proposal is submitted by the ICC Committee on Healthcare (CHC). The CHC was established by the ICC Board to evaluate and assess contemporary code issues relating to healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2017 and 2018 the CHC held 4 open meetings and numerous conference calls, *which included members of the committees as well as any interested parties, to discuss and debate the proposed changes*. Information on the CHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CHC effort can be downloaded from the CHC website at: <https://www.iccsafe.org/codes-tech-support/cs/icc-committee-on-healthcare/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is editorial.

EB47-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

1301.6.21.2 Care recipient concentration. Evaluate the concentration of ~~patients-care recipients~~ in each smoke compartment under Section 1301.6.21.2. Under the categories and occupancies in Table 1301.6.21.2 determine the appropriate value and enter that value in Table 1301.7 under Safety Parameter 1301.6.21.2, Care Recipient Concentration, for means of egress and general safety.

1301.6.21.3.1 Categories. The categories for attendant-to-~~patient~~ care recipient concentrations are:

1. Category a—attendant-to-care recipient concentration is 1:5.
2. Category b—attendant-to-care recipient concentration is 1:6 to 1:10.
3. Category c—attendant-to-care recipient concentration is greater than 1:10 or no ~~patients-care recipients~~.

Committee Reason: This proposal simply updates to the correct term “care recipients” from “patient.” The modification simply addresses a couple locations in Chapter 13 where this revision was missed. (Vote: 13-0)

Assembly Action:

None

EB47-19

Individual Consideration Agenda

Public Comment 1:

IEBC®: 1301.6.21.3, TABLE 1301.6.21.3, 1301.6.21.3.1 (New)

Proponents:

John Williams, representing Healthcare Committee (ahc@iccsafe.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

1301.6.21.3 Attendant-to-patient ratio. Evaluate the attendant-to-patient ratio for each compartment under Section 1301.6.21.3. Under the categories and occupancies in Table 1301.6.21.3 determine the appropriate value and enter that value in Table 1301.7 under Safety Parameter 1301.6.21.3, Attendant-to-patient Ratio, for means of egress and general safety.

**TABLE 1301.6.21.3
ATTENDANT-TO-PATIENT RATIO VALUES**

OCCUPANCY	CATEGORIES		
	a	b	c
I-2	1	2	3

1301.6.21.3.1 Categories. The categories for attendant-to-care recipient concentrations are:

1. Category a - attendant-to-care recipient concentration is 1:5 or no care recipients.
2. Category b - attendant-to-care recipient concentration is 1:6 to 1:10.
3. Category c - attendant-to-care recipient concentration is greater than 1:10 ~~or no care recipients~~.

Commenter's Reason: This is not attended as a technical change. This is intended as a clarification for the categories for attendant-to-care recipient concentrations area. There is no circumstance where a patient will be left unattended in an area of care at any facility.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is a rating system, not a construction requirement.

EB50-19

IEBC®: SECTION 502 (New), 502.1 (New), 502.2 (New), SECTION 602 (New), 602.1 (New), 602.2 (New), 1301.2.5 (New)

Proposed Change as Submitted

Proponents: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com)

2018 International Existing Building Code

Add new text as follows:

SECTION 502 Repairs

502.1 Scope. Repairs, as defined by Chapter 2, include the patching or restoration or replacement of damaged materials, elements, equipment or fixtures for the purpose of maintaining such components in good or sound condition with respect to existing loads or performance requirements.

502.2 Application. Repairs shall comply with the provisions of Chapter 4.

SECTION 602 Repairs

602.1 Scope. Repairs, as defined by Chapter 2, include the patching or restoration or replacement of damaged materials, elements, equipment or fixtures for the purpose of maintaining such components in good or sound condition with respect to existing loads or performance requirements.

602.2 Application. Repairs shall comply with the provisions of Chapter 4.

1301.2.5 Repairs. Repairs shall comply with the provisions of Chapter 4.

Reason: With the 2018 IEBC providing a stand alone chapter specific to repairs, some of the pointers that previously existed appear to have been lost. This code change is providing pointers for all three compliance methods to Chapter 4 for how repairs are to be provided.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact with this code change as it is only adding text for clarification purposes.

EB50-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal was disapproved as the language in chapters 3 and 4 was clear as to how repairs are addressed. Pointers were not felt to be necessary within the prescriptive and work area method. (Vote: 13-0)

Assembly Action:

None

EB50-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com)

requests As Submitted

Commenter's Reason: With the 2018 IEBC providing a stand alone chapter specific to repairs, some of the pointers that previously existed appear to have been lost. This code change is providing pointers for all three compliance methods to Chapter 4 for how repairs are to be provided.

The committee felt the pointers were not necessary as the language in Chapters 3 and 4 was clear on how to address repairs. I disagree, I believe the pointers are necessary to remind the user that repairs do stand on their own merit and have provisions associated with them. Each method should have a pointer indicating how repairs are to be addressed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost impact with this code change as it is only adding text for clarification purposes.

Staff Analysis: Note that Code Change Proposals and associated public comments to EB6-19, EB7-19 and EB50-19 take differing approaches as to how repairs should be addressed in the IEBC. The voting membership should consider the differences and make their intentions clear..

Public Comment# 1600

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Revise as follows:

[BS] 503.4 Existing structural elements carrying lateral load. Except as permitted by Section 503.13, where the *alteration* increases design lateral loads, results in a prohibited structural irregularity as defined in ASCE 7, or decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted.

Exception:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.
2. Buildings in which the increase in the demand capacity ratio is due entirely to the addition of roof top supported mechanical equipment individually having an operating weight less than 400 lb and when the total additional weight of all roof top equipment placed after initial construction of the building is less than 10% of the roof design dead load. For purposes of this exception roof shall mean the roof level above a particular story.
3. Replacement of rooftop mechanical equipment where the new equipment has an operating weight equal to or less that the existing equipment to be replaced.

Reason: Building owners and tenants frequently add or replace roof top mechanical equipment as a part of interior tenant improvement work. Most projects only consider the gravity load effects and ignore contributions to roof dead load and as a result increases to the seismic weight that needs to be resisted by the seismic force resisting system. Additionally, engineers performing the structural design for new buildings determine the total accumulated operating weight of roof top equipment and divide the load by the area of the roof and add the weight in psf to the seismic dead weight. As a consequence, new building designs do not account for localized impacts of roof top equipment. This code change merely codifies current practice. ASCE 7 does not require that anchorage and bracing be determined for supported equipment having a weight of 400 lb or less. Most building departments I polled and review staff indicated that the vast majority of engineers focus merely on support and anchorage and typically do so after the first review cycle since only mechanical plans are provided.

Cost Impact: The code change proposal will decrease the cost of construction

The proposal seeks to limit the need for structural analysis of the lateral force resisting system, and to limit the need for a structural upgrade due to the possible increase in seismic forces and thus the demand capacity ratio, to cases where there is a need to add significantly heavy equipment such as a building maintenance equipment (BMU) to wash and replace windows on a high rise or heavy cooling towers. Currently there is not consistency of enforcement where engineers make a judgement call to not verify compliance and often times the building official only reviews support and anchorage for example on a wood retail building or a concrete tilt-up building.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

[BS] 503.4 Existing structural elements carrying lateral load. Except as permitted by Section 503.13, where the *alteration* increases design lateral loads, results in a prohibited structural irregularity as defined in ASCE 7, or decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.

2. Buildings in which the increase in the demand capacity ratio is due entirely to the addition of roof top supported mechanical equipment individually having an operating weight less than 400 lb and when the total additional weight of all roof top equipment placed after initial construction of the building is less than 10% of the roof design dead load. For purposes of this exception roof shall mean the roof level above a particular story.

~~3. Replacement of rooftop mechanical equipment where the new equipment has an operating weight equal to or less than the existing equipment to be replaced.~~

Committee Reason: This proposal limits the need to hire a structural engineer for small modifications. The floor modification simplifies the proposal and provides clarity. (Vote 13-1)

Assembly Action:

None

EB54-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: [BS] 806.3

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

[BS] 806.3 Existing structural elements resisting lateral loads. Except as permitted by Section 806.4, where the *alteration* increases design lateral loads, or where the alteration results in prohibited structural irregularity as defined in ASCE 7, or where the *alteration* decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted.

Exception-Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.
2. Buildings in which the increase in the demand capacity ratio is due entirely to the addition of roof top supported mechanical equipment individually having an operating weight less than 400 lb and when the total additional weight of all roof top equipment placed after initial construction of the building is less than 10% of the roof dead load. For purposes of this exception roof shall mean the roof level above a particular story.

Commenter's Reason: This PC merely coordinates the IEBC's Prescriptive and Work Area methods, just as changes over the last two cycles have done. EB54 is already approved as modified, but it only included the Prescriptive method (Sec 503.4). For consistency, the same change should be made in the Work Area method (Sec 806.3).

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction For the same reason as stated with proposal EB54-19, already approved as modified.

Public Comment# 1997

EB56-19

IEBC@: (New), [BS] 503.4

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Add new definition as follows:

[BS] PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels, that converts solar radiation into electricity, including rack support systems.

Revise as follows:

[BS] 503.4 Existing structural elements carrying lateral load. Except as permitted by Section 503.13, where the *alteration* increases design lateral loads, results in a prohibited structural irregularity as defined in ASCE 7, or decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted.

Exception:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the International Building Code. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.
2. The installation of rooftop photovoltaic panel systems where the additional roof dead load due to the system, including ballast where applicable, does not exceed 5 psf and 10% of the dead load of the existing roof. For purposes of this exception roof shall mean the common roof above a common story.

Reason: The IEBC includes a needed exception to exempt existing buildings undergoing alterations from compliance with more current seismic requirements in IBC chapter 16. The existing exception uses demand/capacity ratios (DCR) to identify a threshold below which the alteration is not deemed to be significant enough to require an evaluation and possible upgrade of the existing lateral force resisting system. Demand equates to the load applied to the lateral force resisting system and capacity equates the strength of the lateral force resisting system to resist the lateral load. Demand can be impacted by an increase in gravity load, an alternation that redirects load to existing elements in addition to the loads they resist prior to the alteration (such as for example force transfer around and due to a large floor/roof opening). The capacity of existing lateral force resisting elements can be impacted by alterations that cut into the elements such as for example reducing the length of a shearwall. Roof top solar photovoltaic systems, and especially those with ballast, may increase the demand capacity ratio of lateral force resisting systems due to the location of the installation relative to the existing lines of resistance below the roof. For example a building that includes lateral force resisting systems at the interior of the building in addition to those at the exterior may cause an increased DCR at the interior shearwalls due additional tributary loads. As a consequence and without the proposed code change the installation of a rooftop solar system would require that a qualified engineer identify the existing lateral force resisting system (possibly without plans), determine its capacity and determine the demand and thus demonstrate that the DCR increase is not increased by more than 10%.

This requirement imposes a significant burden on buildings constructed with light framed wood construction since unlike other buildings they do not incorporate heavier concrete or steel floors and roofs or heavier concrete or masonry exterior walls. Heavier walls and roofs will allow the roof top installations to easily satisfy the DCR limit.

While unlike Section 503.3 exception 2 where 3 psf is used this code change uses 5 psf as a load threshold to allow for small-ballasted systems to benefit from proposed exception 2. There is no published data demonstrating that alterations involving the installation of rooftop solar photovoltaic caused a life-safety hazard due to a seismic event. It would be difficult to explain to a building owner that the installation of a rooftop solar system necessitates \$2,000 or more in engineering costs and possible upgrades to the lateral force resisting system. ASCE 7 as well as the IBC recognizes that solar voltaic systems are unique and allow seismic force resistance through friction and allow discounting of the roof live load under the rack-mounted assemblies. This proposed code change offers a similar and reasonable accommodation to light weight components that are hand carried on to a roof and which occupy a portion of the roof.

Cost Impact: The code change proposal will decrease the cost of construction

The proposed code change may eliminate the need to develop detailed structural plans to demonstrate the capacity of the existing lateral force resisting system as well as lateral force resisting system upgrades.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt no need for this proposal as the proposed second exception did not provide sufficient information above and beyond the current code first exception. The wording was confusing such as 'whole' or 'partial' roof area to be considered. (Vote: 14-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ali Fattah, representing City of San Diego (alifattah@sbcglobal.net)

requests As Submitted

Commenter's Reason: This code change is being resubmitted for consistency with the committee recommendation for approval made in EB54 which addressed roof top mechanical equipment. Some have argued that EB56 is not necessary since solar PV is a form of roof top equipment. EB56 simply intends to not require establishing capacity to compare to demand for a demand capacity check. Demand, or the lateral load due to seismic forces can be relatively easy to determine. However capacity requires structural plans that show the lateral force resisting system. Plans may not be available or the building may be constructed of conventionally framed light frame construction with prescriptively designed wall bracing that has no capacity.

The committee was confused by testimony in EB 55 that addressed gravity load and included a 3 pdf exemption. Prior to the 2018 the IEBC did not limit the weight of roof covering replacement so my jurisdiction used 5 psf since that would be the weight of one additional layer including underlayment.

The proposed code change addresses impacts to the lateral force resisting system of the building and not the gravity loads. The anchorage and support requirements still apply and based on the limits within the proposal a structural engineer will have to verify the adequacy of the roof for gravity loads but will not have the owner incur additional design expense to establish the design/capacity ratio.

Some have argued that since the alteration is simply adding dead load then the demand capacity determination will be simple and that the Building Official should ignore the capacity portion of the requirement simply focus on the load. Actually reading the code does not lead to this conclusion.

Demand capacity ratios are an elegant way to capture the effects of alterations to the lateral force resisting system such as reducing capacity, redirecting more load to existing lateral force resisting systems or adding mass.

We request that the voting members support reconsideration of the committee's determination during the CAH and vote yes in support of the code change.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction This will reduce the need to develop structural plans beyond a roof framing plan.

EB61-19

IEBC: 503.17 (New), 701.3 (New), 702.7 (New), 703.2 (New), 703.3 (New), 703.4 (New), 704.2 (New), 704.3 (New), 802.2.2 (New), 802.3

Proposed Change as Submitted

Proponents: John Williams, representing Healthcare Committee (AHC@iccsafe.org); Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

SECTION 503 ALTERATIONS

Add new text as follows:

503.17 Group I-2. In Group I-2 occupancies, existing elements within the area undergoing alterations shall comply with Chapter 11 of the International Fire Code.

SECTION 701 GENERAL

Add new text as follows:

701.3 Group I-2. In Group I-2 occupancies, existing elements within the work area shall comply with Chapter 11 of the International Fire Code.

SECTION 702 BUILDING ELEMENTS AND MATERIALS

Add new text as follows:

702.7 Group I-2, Condition 2 location. Existing Group I-2, Condition 2 shall not be located on a floor level higher than the floor level limitation in Table 1105.3 of the International Fire Code based on the type of construction.

SECTION 703 FIRE PROTECTION

Add new text as follows:

703.2 Incidental uses in Group I-2. In Group I-2 occupancies, existing incidental use areas within the work area shall comply with Section 1105.4 of the International Fire Code.

703.3 Corridor construction in Group I-2. In Group I-2 occupancies, existing corridors, including openings, within the work area shall comply with Section 1105.5 of the International Fire Code.

703.4 Waste and linen chutes. In Group I-2 occupancies, existing waste and linen chutes shall comply with Sections 1103.4.9 of the International Fire Code.

SECTION 704 MEANS OF EGRESS

Add new text as follows:

704.2 Means of egress in Group I-2. In Group I-2 occupancies, existing means of egress within the work area shall comply with Sections 1105.1 and 1105.6 of the International Fire Code.

704.3 Group I-2 care suites. Care suites in existing Group I-2, Condition 2 occupancies shall comply with Sections 407.4.4 through 407.4.4.6.2 of the International Building Code.

Revise as follows:

SECTION 802 BUILDING ELEMENTS AND MATERIALS

Add new text as follows:

802.2.2 Group I-2 and I-3 occupancies. In Group I-2 and I-3 occupancies, interior vertical openings connecting two or more stories shall comply with Section 1103.4.1 of the International Fire Code.

Revise as follows:

802.3 Smoke compartments. In Group I-2 occupancies where the *work area* is on a story used for sleeping rooms for more than 30 patients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the International Building Code as required for new construction. Existing smoke barriers shall comply with Section 1105.7.2 through 1105.7.6 of the International Fire Code.

Reason: The Healthcare committee worked over the last several cycles to match the federal requirements for Medicare reimbursement (K-tags) with the IFC requirements for existing buildings. While this is required for most existing hospitals, not everything is caught during survey. A cross check of these basic requirements during the review of alteration projects would be a useful mechanism to increase compliance. Where there are alterations, there is the opportunity to make sure existing elements within the work area comply. Therefore, the requirements for hospitals in IFC Chapter 11 should be referenced in the IEBC.

The scope of this committee is limited to healthcare, so this proposal does not bring in requirements for uses other than that that are addressed in the IFC Chapter 11.

This proposal is submitted by the ICC Committee on Healthcare (CHC). The CHC was established by the ICC Board to evaluate and assess contemporary code issues relating to healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2017 and 2018 the CHC held 4 open meetings and numerous conference calls, *which included members of the committees as well as any interested parties, to discuss and debate the proposed changes.* Information on the CHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CHC effort can be downloaded from the CHC website at: <https://www.iccsafe.org/codes-tech-support/cs/icc-committee-on-healthcare/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. These requirements are bare minimum standards for all existing buildings and would be a requirement whether a facility is performing renovations or not.

EB61-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

~~**703.4 Waste and linen chutes.** In Group I-2 occupancies, existing waste and linen chutes shall comply with Sections 1103.4.9 of the International Fire Code.~~

Committee Reason: This proposal was approved as it further aligns with federal requirements for existing healthcare facilities by referencing the specific Group I-2 requirements in Chapter 11 of the IFC. The modification removes the waste and linen chute requirements as such requirements would create confusion with the work area concept. (Vote: 13-0)

Assembly Action:

None

EB61-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests Disapprove

Commenter's Reason: ADM8-19 added the following text to IEBC Chapter 1:

"101.2.1 Application of fire code. Where work regulated by this code is also regulated by the construction requirements for existing buildings in Chapter 11 of the International Fire Code, such work shall comply with applicable requirements in both codes."

With this text providing a broad reference to IFC Chapter 11, individual pointed references spread throughout the IEBC are unnecessary, and there is an implication of ..."well, if only these sections are being referenced in a specific section of the code, is compliance with the rest of IFC Chapter 11

not necessary to these applications?" It is better to let the general reference in Chapter 1 prevail and not include partial/incomplete references on specific topics elsewhere in the code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2031

EB80-19

IEBC@: 803.4.4 (New)

Proposed Change as Submitted

Proponents: Thomas Daly, HSCG, representing HSCG (Thomas.Daly@myhscg.com)

2018 International Existing Building Code

Add new text as follows:

803.4.4 Smoke Alarms replacement. Where existing smoke alarms in sleeping units of Group I and R occupancies, requiring only a single smoke alarm without interconnection, are to be replaced, ten-year listed sealed battery powered smoke alarms shall be permitted, as an option.

Reason:

1. The 2018 IFC requires smoke alarms in occupancies other than one and two-family dwellings to be replaced if non-functional or when they have reached 10 years of age. ICC Interpretation 01-18 issued 5.15.18 and re-affirmed 8.15.18 expanded that mandate to impact existing smoke alarms in existing buildings. That Interpretation also indicated that such replacement was deemed 'maintenance' not 'construction'.

As such, the IEBC and, in the next cycle the IPMC, are the requisite codes in which to make this change since the IFC specifies construction requirements for smoke alarms. As the IPMC was included in Group A codes, only the IEBC remains available now to amend.

1. History – 10-yr smoke alarms were first allowed in the 2002 edition of NFPA 72, see Sec. 11.6.1(3) and continue to be allowed, see the 2019 edition of NFPA 72 Sec. 29.9.1(3) and 29.9.2.

This technology gained favor among both fire officials and the public as it precluded the removal of the battery (a known factor in residential fire deaths) and avoided the periodic replacement of such batteries, typically annually, for battery only powered smoke alarms or the back-up battery in 120vac powered smoke alarms (often ignored by property owners).

Since being introduced most major smoke alarm manufacturers have provided this optional 10-yr smoke alarm technology, see for example, Kidde Model i9010, <https://www.kidde.com/home-safety/en/us/products/fire-safety/smoke-alarms/i9010/>

and First Alert Model SA340CN, <https://www.firstalertstore.com/store/products/sa340cn-tamperproof-10-year-smoke-alarm.htm>.

There have been no reported recalls of 10-yr smoke alarms based on a review of the Consumer Product Safety Commission (CPSC) website, see https://cpsc.gov/search?site=cpsc_site&output=xml_no_dtd&getfields=*&tlen=120&client=ek_drupal_01&proxystylesheet=ek_drupal_01&filter=p&query=smoke+alarm+re

As such, 10-yr smoke alarms have a proven track record of reliability.

Further, NFPA studies, see for example <https://www.nfpa.org/News-and-Research/Data-research-and-tools/Detection-and-Signaling/Smoke-Alarms-in-US-Home-Fires>,

indicate the reason for smoke alarm failures and subsequent injuries and deaths in fires are most related to the failure to replace a battery for battery only smoke alarms, the failure of the replacement back-up battery for 120vac models when power failures occur and the removal of batteries for other purposes.

The 10yr battery powered smoke alarm removes these failure mode potentials, so is more reliable and is likely to save lives.

NFPA 72 has permitted 10-yr battery only smoke alarms for more than a decade and our Work Group has been directed by the FCAC to align the I-Codes with NFPA 72 to the extent possible.

2. Cost impact - The retail price differential between a traditional smoke alarm (120vac powered with a 9vac battery backup) and 10-yr smoke alarms is about \$13 (\$35 for the former and \$22 for the latter based on retail prices at Home Depot October 2018).

Given the number of commercial occupancies involved (hotels, apartments, condominiums, dormitories, board and care facilities, assistive living facilities and time-shares) the number of smoke alarms to be replaced in the near-term (2019-2022), as the 2018 IFC is adopted state-by-state, is estimated at more than 200 million based on the ten-year age replacement obligation and in such occupancies' sleeping accommodations where only one smoke alarm is required. The cost savings to those owner/operators is thus estimated at \$2.6 billion, if 10-yr smoke alarms technology could replace traditional 120vac/9vac powered smoke alarms.

Bibliography: NFPA 72 -2019 and manufacturerers literature noted.

Cost Impact: The code change proposal will decrease the cost of construction

The proposed code change would decrease the cost of operations for occupanices utilizing single station smoke alarms.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal was disapproved as it was felt to result in the reduction in fire safety as it allows battery only smoke alarm replacement where the current smoke alarms are already hardwired into the building. Additionally, this appears to be a subject better addressed in the IFC versus IEBC. (Vote: 13-0)

Assembly Action:

None

EB80-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 803.4.3, 803.4.4 (New)

Proponents:

Thomas Daly, representing HSCG (thomas.daly@myhscg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

803.4.3 Smoke alarms. Individual sleeping units and individual dwelling units in any *work area* in Group R and I-1 occupancies shall be provided with smoke alarms in accordance with the International Fire Code .

Exception Exceptions:

1. Interconnection of smoke alarms outside of the *work area* shall not be required.
2. Where existing smoke alarms in sleeping units of Group I-1 and R occupancies requiring only a single smoke alarm without interconnection are to be replaced, ten-year listed sealed battery powered smoke alarms shall be permitted.

~~**803.4.4 Smoke Alarms replacement.** Where existing smoke alarms in sleeping units of Group I and R occupancies, requiring only a single smoke alarm without interconnection, are to be replaced, ten-year listed sealed battery powered smoke alarms shall be permitted, as an option.~~

Commenter's Reason: As stated in the floor modification (DALY 3) to place the option in an exception rather than in a sub-section.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The change would decrease the cost of operations as further explained in the original proposal.

Public Comment# 1956

EB82-19

IEBC@: 803.2.2

Proposed Change as Submitted

Proponents: Kevin Duerr-Clark, New York State Department of State, representing New York State Department of State (kevin.duerr-clark@dos.ny.gov); John Addario, New York State Department of State - Building Standards & Codes, representing New York State Department of State (john.addario@dos.ny.gov)

2018 International Existing Building Code

Revise as follows:

803.2.2 Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where both of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the International Building Code as applicable to new construction.
2. The *work area* exceeds 50 percent of the floor area.

Exception: If the building does not ~~have sufficient municipal water supply for~~ have an existing municipal water supply present at the floor of the proposed work area, with sufficient pressure and flow for the design of a fire sprinkler system available to the floor without, and without installation of a new fire pump, ~~work-service piping, or vertical piping,~~ the *work areas* shall be protected by an automatic smoke detection system throughout all occupiable spaces other than sleeping units or individual dwelling units that activates the occupant notification system in accordance with Sections 907.4, 907.5 and 907.6 of the International Building Code.

Reason: There is some confusion surrounding the language of the exception to this section. Some interpret that "sufficient municipal supply available to the floor" means a water main is in the ROW with adequate pressures and flow, and available to tap into with new piping to the building and work area. As supported by the ICC IEBC Interpretation No. 12-04 (see attached), it was never intended for a new water service pipe or vertical/riser pipes to be installed as a requirement for "sufficient municipal supply" to satisfy this code section. The newly proposed language makes it clear that the existing sufficient municipal supply is to exist and be available to the floor where the work area is located without the installation of new service piping, fire pump, or vertical piping.

Commentary to this code section states *"One exception to these requirements states that if the building does not have a sufficient municipal water supply for a sprinkler system at the floor where the work area is located, then sprinklers are not required; however, that same exception does require an automatic smoke detection system throughout the work area. The smoke detection coverage is required throughout all occupiable spaces other than areas already required to install smoke alarms."* While useful in understanding this code section, in many cases the Commentary is not available or enforceable. This proposal brings the stated intent of in the Commentary into the actual Code language.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is simply a clarification of the language as already interpreted by ICC and the commentary, so no change in the construction cost is anticipated.

EB82-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved with concern that the terminology "service piping" and "vertical piping" is not consistent with NFPA 13. Note there were some on the committee of the opinion that the language proposed would provide more guidance for a common scenario to determine if sprinklers are feasible. (Vote: 8-5)

Assembly Action:

None

EB82-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 803.2.2

Proponents:

Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov); Felix Zemel, representing ICC Region 6 -- North East Regional Coalition (felix@pracademicsolutions.com); Peter Zvingilas, Town of Groton and Voluntown, CT, representing Region VI (pzvingilas@voluntown.gov); Emma Gonzalez-Laders, representing New York State Department of State (emma.gonzalez-laders@dos.ny.gov); John Addario, representing New York State Department of State (john.addario@dos.ny.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

803.2.2 Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where both of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the International Building Code as applicable to new construction.
2. The *work area* exceeds 50 percent of the floor area.

Exception: If the building does not have an existing ~~municipal~~ water supply present at the floor of the proposed work area, with sufficient pressure and flow for the design of a sprinkler system, and without installation of a new fire pump, private fire service main, or fire sprinkler riser, ~~service piping, or vertical piping~~, the *work areas* shall be protected by an automatic smoke detection system throughout all occupiable spaces other than sleeping units or individual dwelling units that activates the occupant notification system in accordance with Sections 907.4, 907.5 and 907.6 of the International Building Code.

Commenter's Reason: The proposal should be Approved as Modified by This Public Comment

The original proposal was based on ICC code interpretation 12-04 issued on 04-07-2005. In response to the committee's concerns, this public comment does two things:

1. It replaces the undefined terms "service piping" and "vertical piping" with terms defined in NFPA 13 ("private fire service main" and "fire sprinkler riser").
2. It removes the term "municipal" as the committee felt that the term did not accurately represent the intent of the provision, which is for the water supply to be available at the floor.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This is a clarification of an existing provision

Public Comment# 1942

EB94-19

IEBC: 905.4 (New), 503.17 (New)

Proposed Change as Submitted

Proponents: Dawn Anderson, representing self (gonedawning@yahoo.com); Gene Boecker, representing Code Consultants, Inc. (geneb@codeconsultants.com); Dan Buuck, representing National Association of Home Builders (dbuuck@nahb.org); David Collins, representing the American Institute of Architects (dcollins@preview-group.com); Marsha Mazz, representing United Spinal Association (m.mazz@verizon.net)

2018 International Existing Building Code

SECTION 905 MEANS OF EGRESS

905.1 General. The means of egress shall comply with the requirements of Section 805 except as specifically required in Sections 905.2 and 905.3.

905.2 Means-of-egress lighting. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with artificial lighting within the exit enclosure in accordance with the requirements of the International Building Code .

905.3 Exit signs. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with exit signs in accordance with the requirements of the International Building Code .

Add new text as follows:

905.4 Two-way communications systems. In buildings with elevator service, a two way communication system shall be provided in accordance with Section 1009.8 of the International Building Code.

SECTION 503 ALTERATIONS

Add new text as follows:

503.17 Two-way communications systems. Where the work area for alterations exceeds 50 percent of the building area and the building has elevator service, a two way communication systems shall be provided in accordance with Section 1009.8 of the International Building Code.

Reason: The addition of Sections 503.7 and 905.4 would allow for a person who could not use the stairways for evacuation to at least have a way to contact emergency responders. Since this is only alteration of Level 3 or exceeds 50% of the building area, this would have minimal impact on the construction and would be a big boost for persons who needed assistance in evacuation and the fire department.

Cost Impact: The code change proposal will increase the cost of construction
A two way communication system may need to be added in older multi-story buildings that were undergoing Level 3 alterations.

EB94-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The addition of 2-way communication in existing buildings are necessary for those that are unable to take the stairways. In addition placing in larger alterations (over 50% area of the building) was a seen as a reasonable trigger for these requirements. (Vote: 13-0)

Assembly Action:

None

EB94-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: SECTION 905, 905.1, 905.2, 905.3, 905.4 (New), SECTION 503, 503.17 (New)

Proponents:

John Williams, representing Healthcare Committee (ahc@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

SECTION 905 MEANS OF EGRESS

905.1 General. The means of egress shall comply with the requirements of Section 805 except as specifically required in Sections 905.2 and 905.3.

905.2 Means-of-egress lighting. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with artificial lighting within the exit enclosure in accordance with the requirements of the International Building Code .

905.3 Exit signs. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with exit signs in accordance with the requirements of the International Building Code .

905.4 Two-way communications systems. In buildings with elevator service, a two way communication systems shall be provided where required by ~~in accordance with~~ Section 1009.8 of the International Building Code.

SECTION 503 ALTERATIONS

503.17 Two-way communications systems. Where the work area for alterations exceeds 50 percent of the building area and the building has elevator service, a two way communication systems shall be provided where required by ~~in accordance with~~ Section 1009.8 of the International Building Code.

Commenter's Reason: There is a concern that this requirement could be read to require two way communication systems where it was not required in new construction. Currently Section 1009.8 has six exceptions for two way communication systems. This is intended to be a clarification only and does not change the intent of the original proposal.

This proposal is submitted by the ICC Ad Hoc Committee on Healthcare (AHC). The AHC was established by the ICC Board of Directors to evaluate and assess contemporary code issues relating to hospitals and ambulatory healthcare facilities. The AHC is composed of building code officials, fire code officials, hospital facility engineers, and state healthcare enforcement representatives. The goals of the committee are to ensure that the ICC family of codes appropriately addresses the fire and life safety concerns of a highly specialized and rapidly evolving healthcare delivery system. This process is part of a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. Since its inception in April, 2011, the AHC has held 6 open meetings and over 80 workgroup calls which included members of the AHC as well as any interested party to discuss and debate the proposed changes. All meeting materials and reports are posted on the AHC website at: <http://www.iccsafe.org/cs/AHC/Pages/default.aspx> .

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. While the original proposal would be an increase where adding two-way communication systems, the modification would clarify where adding such systems would not be required. This would be a savings both initially and from a long term operational standpoint.

Public Comment# 1207

EB95-19

IEBC: SECTION 908 (New), 908.1 (New), 1010.2 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

Add new text as follows:

SECTION 908 **EMERGENCY RESPONDER RADIO COVERAGE**

908.1 Emergency responder radio coverage in existing buildings. Where existing buildings do not have an approved emergency responder radio coverage in the building based on existing coverage levels of the public safety communication systems, an approved emergency responder radio coverage system shall be installed within the building in compliance with Section 510 of the International Fire Code.

SECTION 1010 **OTHER REQUIREMENTS**

1010.1 Light and ventilation. Light and ventilation shall comply with the requirements of the International Building Code for the new occupancy.

Add new text as follows:

1010.2 Emergency responder radio coverage in existing buildings. Where an existing building undergoes a complete change of occupancy, and the building does not have an approved emergency responder radio coverage based on existing coverage levels of the public safety communication systems, an approved emergency responder radio coverage system shall be installed within the building in compliance with Section 510 of the International Fire Code. The system shall be installed within the time frame established by the code official.

Reason: For jurisdictions that do not adopt the Chapter 11 (retroactive) requirements of the IFC for Emergency Responder Radio Coverage, this proposal would add triggers to the IEBC that would require all existing buildings that undergo a Level 3 alteration or Change of Occupancy to have approved radio coverage. Providing these two triggers for Emergency Responder Radio Coverage provides a reasonable opportunity to install equipment and systems that ensure the safety of emergency responders that depend on reliable communication for their safety. We are not asking for this in a building undergoing a partial change of occupancy with a Level 1 or 2 alteration because that could be only one tenant in a very large multi-tenant building. IFC Section 510 includes all the requirements for the design and installation. Allowing for a time frame for installation in a COO is consistent with IFC Section 1103.2.

This proposal will correlate consistency between the IFC and the IEBC as it relates to the requirements for emergency responder radio coverage in existing buildings.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will increase the cost of construction
For the safety of emergency responders, a system may need to be added in some of the larger buildings.

EB95-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The provisions for emergency responder radio coverage is appropriate for existing buildings undergoing level 3 alterations or a change of occupancy classification. The requirements are also consistent with the IFC that contains retroactive provisions for radio coverage.
(Vote: 12-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IEBC@: SECTION 908 (New), 908.1 (New), 1010.2 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

SECTION 908 EMERGENCY RESPONDER RADIO COMMUNICATION COVERAGE

908.1 Emergency responder ~~radio-communication~~ coverage in existing buildings. Where existing buildings do not have an approved in building 2-way emergency responder ~~radio-communication~~ coverage in the building based on existing coverage levels of the public safety communication systems, an approved in building 2-way emergency responder ~~radio-communication~~ coverage system shall be installed within the building in compliance with Section 510 of the International Fire Code.

1010.2 Emergency responder ~~radio-communication~~ coverage in existing buildings. Where an existing building undergoes a complete change of occupancy, and the building does not have an approved in building 2-way emergency responder ~~radio-communication~~ coverage based on existing coverage levels of the public safety communication systems, an approved in building 2-way emergency responder ~~radio-communication~~ coverage system shall be installed within the building in compliance with Section 510 of the International Fire Code. The system shall be installed within the time frame established by the code official.

Commenter's Reason: This revision is a coordination item with F45-18 so that there is consist terminology in the IFC and IEBC for these requirements.

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-techsupport/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The modification will not change the cost of the proposal, however, for the entire proposal, for the safety of emergency responders, a system may need to be added in some of the larger buildings.

Public Comment# 1221

Public Comment 2:

Proponents:

Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests Disapprove

Commenter's Reason: ADM8-19 added the following text to IEBC Chapter 1:

"101.2.1 Application of fire code. Where work regulated by this code is also regulated by the construction requirements for existing buildings in Chapter 11 of the International Fire Code, such work shall comply with applicable requirements in both codes."

With this text providing a broad reference to IFC Chapter 11, individual pointed references spread throughout the IEBC are unnecessary, and there is an implication of ..."well, if only these sections are being referenced in a specific section of the code, is compliance with the rest of IFC Chapter 11 not necessary to these applications?" It is better to let the general reference in Chapter 1 prevail and not include partial/incomplete references on specific topics elsewhere in the code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2034

EB103-19

IEBC@: 1011.2.1.1 (New), 1011.2.1.1.1 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

Add new text as follows:

1011.2.1.1 Nonrequired automatic sprinkler systems. The code official is authorized to permit the removal of existing automatic sprinkler system where all of the following conditions exist:

1. The system is not required for new construction.
2. The system is removed in its entirety throughout the building.
3. The system was not installed as part of any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means of egress conditions, fire code deficiencies, approved modifications or approved alternative materials, design and methods of construction, and equipment applying to the building.

1011.2.1.1.1 Approval. Plans, investigation and evaluation reports, and other data shall be submitted documenting compliance with Items 1 and 2 of Section 1011.2.1.1 for review and approval in support of a determination authorizing the removal of the automatic sprinkler system by the code official.

Reason: A change of occupancy could be to an occupancy that did not require a sprinkler system. If the system was old, outdated or needed extensive reconfiguration, costs could be high. The new Section 1011.2.1.1 allows for non required systems to be removed. To be removed the designer/building owner would have to demonstrate to the code official that the building did not need the sprinklers for occupancy, fire areas or type of construction limitations, and that none of the trade off's for items such as travel distance or corridor rating were in effect in the building. The system would have to be removed totally – including the system in the ceiling, standpipes and the connections for the fire department outside of the building.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. There will be the cost of removal, but this may be less than the cost of repairing or replacing an older system.

EB103-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

1011.2.1.1 Nonrequired automatic sprinkler systems. The code official is authorized to permit the removal of existing automatic sprinkler system where all of the following conditions exist:

1. The system is not required for new construction.
2. Portions of the system that are obvious to the public are removed. ~~The system is removed in its entirety throughout the building.~~
3. The system was not installed as part of any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means of egress conditions, fire code deficiencies, approved modifications or approved alternative materials, design and methods of construction, and equipment applying to the building.

Committee Reason: This proposal provides a reasonable approach for the removal of non-required systems based upon a series of criteria such systems are not required by the IBC. One of the criteria was that it be removed in its entirety which was seen as excessive and the true concern is to not provide a false sense of security of such systems to occupants. Therefore, the modification clarifies that such systems only need to be removed from areas where they are visible to occupants. This addresses the intent and reduces the costs. It should be noted that there was some concern with the concept of the removal of working systems even though they are not required. It was suggested that feedback should be obtained from the fire service on this issue. (Vote: 9-4)

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jeffrey Hugo, representing National Fire Sprinkler Association (hugo@nfsa.org)

requests Disapprove

Commenter's Reason: The proposed 1011.2.1.1.1 only requires an evaluation report or an investigation to remove the non-required sprinkler system if sprinklers are not required for new construction and if the public portions of the systems are removed. It doesnt include #3 of 1011.2.1.1. The committee did not contemplate many buildings are sprinklered because of fire flow, setback, grade, appeals, wildland urban interface, etc and are done without being specific to the occupancy of the building.

Removing the sprinkler system solely on a change to another occupancy could negate an agreement made long ago between the owner and another enforcing agency of the jurisdiction, i.e. fire department, water department, etc.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 2037

EB104-19

IEBC@: 1011.7.2 (New), 1011.7.4 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

Revise as follows:

1011.7.2 Stairways. Where a change of occupancy classification is made to a higher-hazard category as shown in Table 1011.4, interior stairways shall be enclosed as required by the International Building Code .

Exceptions:

1. In other than Group I occupancies, an enclosure shall not be required for openings serving only one adjacent floor and that are not connected with corridors or stairways serving other floors.
2. Unenclosed existing stairways need not be enclosed in a continuous vertical shaft if each story is separated from other stories by 1-hour fire-resistance-rated construction or *approved* wired glass set in steel frames and all exit corridors are sprinklered. The openings between the corridor and the occupant space shall have not fewer than one sprinkler head above the openings on the tenant side. The sprinkler system shall be permitted to be supplied from the domestic water-supply systems, provided that the system is of adequate pressure, capacity, and sizing for the combined domestic and sprinkler requirements.
3. ~~Existing penetrations of stairway enclosures shall be accepted if they are protected in accordance with the International Building Code Stairways enclosed in compliance with the applicable provisions of Section 903.1.~~

1011.7.4 Openings. Openings into existing vertical shaft enclosures shall be protected by fire assemblies having a fire protection rating of not less than 1 hour and shall be maintained self-closing or shall be automatic-closing by actuation of a smoke detector. Other openings shall be fire protected in an *approved* manner. Existing fusible linktype automatic door-closing devices shall be permitted in all shafts except stairways if the fusible link rating does not exceed 135° F (57° C).

Exception: Existing penetrations of stairway enclosures shall be accepted if they are protected in accordance with the International Building Code.

Reason: This is an editorial correction. Without this exception, the means of egress allowance to use the provisions of Section 903.1 (and 802.2) would not be applicable in change of occupancy classification with alterations projects. This will make the requirements consistent and provide a pointer to 903.1. The exception related to openings (1011.7.2 Exception 3) is moved to Section 1011.7.4 since that deals with openings into exiting vertical shafts.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal is an editorial correction and may reduce potential costs by providing design options.

EB104-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved with concern that it will remove a necessary exception. The proposal makes inadvertent technical changes. The intent is understood but further work is necessary to provide the clarity intended by the revisions. (Vote: 13-0)

Assembly Action:

None

EB104-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 1011.7.2 (New), 1011.7.4 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

1011.7.2 Stairways. Where a change of occupancy classification is made to a higher-hazard category as shown in Table 1011.4, interior stairways shall be enclosed as required by ~~the International Building Code~~ Section 903.1.

Exceptions:

1. In other than Group I occupancies, an enclosure shall not be required for openings serving only one adjacent floor and that are not connected with corridors or stairways serving other floors.
2. Unenclosed existing stairways need not be enclosed in a continuous vertical shaft if each story is separated from other stories by 1-hour fire-resistance-rated construction or *approved* wired glass set in steel frames and all exit corridors are sprinklered. The openings between the corridor and the occupant space shall have not fewer than one sprinkler head above the openings on the tenant side. The sprinkler system shall be permitted to be supplied from the domestic water-supply systems, provided that the system is of adequate pressure, capacity, and sizing for the combined domestic and sprinkler requirements.
3. Existing penetrations of stairway enclosures shall be accepted if they are protected in accordance with the International Building Code.
~~Stairways enclosed in compliance with the applicable provisions of Section 903.1.~~

1011.7.4 Openings. Openings into existing vertical shaft enclosures shall be protected by fire assemblies having a fire protection rating of not less than 1 hour and shall be maintained self-closing or shall be automatic-closing by actuation of a smoke detector. Other openings shall be fire protected in an *approved* manner. Existing fusible linktype automatic door-closing devices shall be permitted in all shafts except stairways if the fusible link rating does not exceed 135° F (57° C).

~~**Exception:** Existing penetrations of stairway enclosures shall be accepted if they are protected in accordance with the International Building Code.~~

Commenter's Reason: This public comment addressed issues brought up during the testimony and the reason for the committee disapproval. The modification would allow for the stairways to comply with the provisions in the IEBC instead of requiring compliance with the IBC. Leaving Exception 3 as it was before would allow for items such as standpipes in stairways to meet IBC penetration requirements. The ultimate goal was to allow for existing stairways to meet the same requirements for new tenants if that new tenant is the same use or not. This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. Stairways in a COO would be allowed to use the exit stairway requirements currently allowed for Level 2 and 3 alterations, which can be less than new IBC requirements.

Public Comment# 1177

EB111-19

IEBC@: 1203.3 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Existing Building Code

Revise as follows:

1203.3 Means of egress. Existing door openings and corridor and stairway widths less than those specified elsewhere in this code may be ~~approved, provided that, Where,~~ in the opinion of the code official, there is sufficient width and height for a person to pass through the opening or traverse the means of egress. ~~egress, existing door openings and corridor and stairway widths not required to meet the widths required by the International Building Code or this code.~~ Where *approved* by the code official, the front or main exit doors need not swing in the direction of the path of exit travel, provided that other *approved* means of egress having sufficient capacity to serve the total occupant load are provided.

Reason: This addresses non mandatory language and also addresses the fact that this is likely intending to refer also to the IBC. This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is editorial.

EB111-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was intended to be editorial but there appeared to be some incomplete language in the proposal that needs to be addressed during public comment. (Vote: 12-1)

Assembly Action:

None

EB111-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: 1203.3 (New)

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

1203.3 Means of egress. Where, in the opinion of the code official, there is sufficient width and height for a person to pass through the opening or traverse the means of egress, existing door openings and corridor and stairway widths are not required to meet the widths required by the International Building Code or this code. Where *approved* by the code official, the front or main exit doors need not swing in the direction of the path of exit travel, provided that other *approved* means of egress having sufficient capacity to serve the total occupant load are provided.

Commenter's Reason: There was a small modification needed to correct the grammar in the proposal. The intent remains the same as stated in the original reason.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This modification is an editorial correction.

Public Comment# 1178

EB133-19

IEBC@: (New), 1402.8 (New)

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

2018 International Existing Building Code

Add new definition as follows:

WILDLAND-URBAN INTERFACE AREA. That geographical area where structures and other human development meets or intermingles with wildland or vegetative fuels.

Add new text as follows:

1402.8 Wildland-Urban Interface Areas. If moved into a *wildland-urban interface area*, buildings shall comply with the *International Wildland-Urban Interface Code* as applicable.

Exception: Buildings previously located in a *wildland-urban interface area* or moved within a *wildland-urban interface area*.

Reason: The wildland-urban interface code provides additional building standards for buildings subjected to fire hazards within a *wildland-urban interface area* and as a result are subject the increased fire risk when relocated into such an area. The Scope of Section 101.2 of the IWUIC includes moved buildings. This code change merely correlates the two codes. The alterations Sections are not proposed to be amended nor is an exception being added for historical buildings to allow local jurisdictions to determine whether to exempt their historical resources or exterior building alterations from from compliance. It makes no sense that if a building is moved to a vacant lot that a site built adjacent building is required to satisfy WUI regulations but not the relocated building.

Cost Impact: The code change proposal will increase the cost of construction
By moving a building into a wui area the exterior roof, walls and openings may require upgrading. However the cost of the enhanced protection will provide a community benefit since in the WUI it is not unusual for conflagration hazards to occur when non compliant buildings burn and expose compliant buildings to hazards that they were not quite designed for since exterior fire fighting suppression may not be available to control the non-compliant building.

EB133-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved with concern that it may not be the correct location for such provisions. Another concern was how the exception would be applied as the IWUIC not only includes construction requirements but also addresses the need for clear space. (Vote: 13-0)

Assembly Action:

None

EB133-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: (New), 1402.8 (New)

Proponents:

Ali Fattah, representing City of San Diego (alifattah@sbcglobal.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

WILDLAND-URBAN INTERFACE AREA. That geographical area where structures and other human development meets or intermingles with wildland or vegetative fuels.

1402.8 Wildland-Urban Interface Areas. If moved into a *wildland-urban interface area*, buildings shall comply with the *International Wildland-Urban Interface Code* as applicable.

~~**Exception:** Buildings previously located in a *wildland-urban interface area* or moved within a *wildland-urban interface area*.~~

Commenter's Reason: The proposed code change is intended to correlate the IEBC with the IUWIC. During the CAH there was support for the proposal from some commenters and some members of the committee however they found that the exception to be confusing. It was intended to recognize that the moved building when moved within the WUI Area is not experiencing more fire risk since when it was first constructed. However, the building may have been constructed prior to WUI building standards. As such the exception is proposed to be deleted as a part of this public comment.

Commenter at the CAH confused a moved building with a relocatable building. A moved building is an existing site-built building that is raised in whole and in part and put on a truck and moved. It's original design and construction did not envision moving it. A relocated building is a building that is designed be transported and factory-built homes are a form of a relocated building and not a moved building. The proposal only applies to moved buildings and not relocated buildings such as mobile homes or manufactured homes.

Interestingly both the IEBC and the IRC address within their scope moved buildings so this code change will not require jurisdictions to adopt the International Wildland Urban Interface Code. The committee reason statement states that this requirement is added in an incorrect location, however IEBC Chapter 14 is for moved buildings and i the IRC includes in the scope Section R101.2 movement of a building. Moved buildings are required to comply with new conditions at the site to which they are to be moved to such as flood, wind, soil and wildfire hazards are another environmental hazard that are not addressed. The proposal merely points back to the WUI code that does regulate the hazard when a building is moved if the WUI code is adopted. We request the voting members support for approval as modified with public comment. We require 2/3 of the governmental voting members for this proposal to pass final action.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The increased cost of construction may be due to the need to replace windows or to change/modify exterior cladding and vent openings.

Public Comment# 1314

EB145-19

IEBC@: [BS] A205.4, A205.5 (New), A205.6 (New)

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Revise as follows:

~~[BS] A205.4 Structural observation, testing and inspection.~~ **observation.** Structural observation, in accordance with Section 1704.6 of the International Building Code, shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. is required, regardless of seismic design category, height, or other conditions. Structural observation shall include visual observation of work for conformance to the *approved* construction documents and confirmation of existing conditions assumed during design.

~~Structural testing and inspection for new construction materials shall be in accordance with the building code, except as modified by this chapter.~~

Add new text as follows:

A205.5 Contractor responsibility. Contractor responsibility shall be in accordance with Section 1704.4 of the International Building Code.

A205.6 Testing and Inspection. Structural testing and inspection for new construction materials, submittals, reports, and certificates of compliance, shall be in accordance with Sections 1704 and 1705 of the International Building Code. Work done to comply with this chapter shall not be eligible for Exception 1 to International Building Code Section 1704.2, Exception 2 to International Building Code Section 1705.12, or the Exception to International Building Code Section 1705.12.2.

Reason: This proposal corrects a code reference and clarifies that typical quality assurance provisions from IBC Chapter 17 apply to Chapter A2 projects.

A205.4: For clarity, the current provision is broken into three subsections. Regarding structural observation, the proposal corrects a mistaken IBC section number and clarifies that the requirement applies despite IBC waivers for buildings of certain heights or assigned to certain seismic design categories.

A205.5: Regarding the contractor statement of responsibility, the proposed new section confirms that IBC section 1704.4 applies.

A205.6: Regarding testing and inspection, proposed Section A205.6 clarifies the existing reference to “the building code” and disallows certain exemptions in IBC Chapter 17 that apply to new construction of a minor nature but should not apply to Chapter A2 retrofits.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal merely clarifies existing requirements. In rare cases, the cost of testing and inspection might increase slightly.

EB145-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal corrects section numbering, clarifies testing and inspection requirements and special inspections regardless of project size. (Vote: 12-2)

Assembly Action:

None

EB145-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: [BS] A205.4, 205.5 (New), A205.5 (New)

Proponents:

Jonathan Siu, representing City of Seattle Department of Construction and Inspections (jon.siu@seattle.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

[BS] A205.4 Structural observation. Structural observation in accordance with Section 1704.6 of the International Building Code is required, regardless of seismic design category, height, or other conditions. Structural observation shall include visual observation of work for conformance to the *approved* construction documents and confirmation of existing conditions assumed during design.

~~**A205.5 Contractor responsibility.** Contractor responsibility shall be in accordance with Section 1704.4 of the International Building Code.~~

A205.6 A205.5 Testing and Inspection Structural testing and inspection for new construction materials, submittals, reports, and certificates of compliance, shall be in accordance with Sections 1704 and 1705 of the International Building Code. Work done to comply with this chapter shall not be eligible for Exception 1 to International Building Code Section 1704.2, Exception 2 to International Building Code Section 1705.12, or the Exception to International Building Code Section 1705.12.2.

Commenter's Reason: This public comment does not change any technical requirements of the code or the proposal--it merely removes unnecessary language contained in the original proposal. The proponent's reason statement says, "...the proposed section confirms that IBC section 1704.4 applies." Taken to its logical conclusion, the reason statement implies if a required section is not cross-referenced, it does not apply--a concept with which we disagree. The proponent has argued in other code change proposals that the rest of the code still applies, so redundant language or cross references aren't necessary--we heartily agree with this concept.

It is unclear to us why this particular reminder is necessary, versus the many other important requirements in IBC Chapter 17. Why not confirm special inspections are required in addition to the normal inspections in Section 110 (IBC 1704.2)? Or confirm that the special inspectors have to be competent and have relevant training and experience (IBC 1704.2.1)? Or confirm any of the reporting requirements that are the responsibility of the design professional or the special inspector (IBC 1704.2.3, 1704.3 and 1704.5)? The proponent did not indicate in either the reason statement or in testimony that this is something that is commonly missed, which would be a reasonable rationale for having cross references.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment does not change technical requirements of the code or the proposal. Given the original proposal had a neutral or minimal cost impact, this public comment will not change that.

Public Comment# 1433

Public Comment 2:

IEBC@: A205.6 (New)

Proponents:

Jonathan Siu, representing City of Seattle Department of Construction and Inspections (jon.siu@seattle.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

A205.6 Testing and Inspection Structural testing and inspection for new construction materials, submittals, reports, and certificates of compliance, shall be in accordance with Sections 1704 and 1705 of the International Building Code. Work done to comply with this chapter shall not be eligible for Exception 1 to International Building Code Section 1704.2, or Exception 2 to International Building Code Section 1705.12, ~~or the Exception to International Building Code Section 1705.12.2.~~

Commenter's Reason: This public comment restores an exception to special inspections for lightly-loaded wood diaphragms that was removed in the original proposal.

The proposal requires special inspections be provided as required in IBC Chapter 17, but then says three exceptions contained in Chapter 17 cannot be used--they aren't available as an option for this type of retrofit. We do not take issue with the two of the exceptions to the Chapter 17 exceptions relating to minor work (IBC 1704.2, Exception 1) or shorter concrete or masonry buildings (IBC 1704.12, Exception 2). However, we do not agree with the need for special inspections of wood shear walls and diaphragms with nail spacing greater than 4 inches (IBC 1705.12.2, Exception).

The concept behind the exception in IBC 1704.12.2 is where the element isn't heavily loaded, special inspection is not required--the hazard or risk is less. If required nail spacing for shear walls and diaphragms is greater than 4 inches, the capacities are lower than the capacities if the nail spacing is 4 inches or less. This is true whether the building is of new construction or is existing. It has been generally accepted this is an indication the wall or diaphragm is not heavily loaded. See 2015 AWC Special Design Provisions for Wind and Seismic Tables 4.2A and 4.2C for comparative nominal diaphragm values, and Tables 4.3A and 4.3B for nominal shear wall values. Because these tables have columns for 6-inch and 4-inch spacing, we're generally talking about diaphragms and shear walls nailed at 6 inches at the panel edges.

Given these diaphragms and shear walls are lightly loaded, we do not see the need to impose more stringent special inspections requirements for existing buildings than is required for new buildings of the same type of construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The original proposal's statement essentially says the cost impact is neutral or marginally more. This public comment will marginally decrease the cost of the proposal, but has no effect on the cost of what the code currently requires, since it doesn't change the current requirements.

Public Comment# 1436

EB147-19

IEBC@: A205.4.1 (New), [BS] A206.2

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Add new text as follows:

A205.4.1 Additional special inspection. In addition to the requirements of International Building Code Section 1705.12, special inspection shall be required for:

1. Installation of continuity connectors along the length of crossties, to ensure properly sized fastener holes and adequate crosstie stiffness.

[BS] A206.2 Special requirements for wall anchorage systems. The steel elements of the wall anchorage system shall be designed in accordance with the International Building Code without the use of the 1.33 short duration allowable stress increase where using allowable stress design.

The wall anchorage system, excluding subdiaphragms and existing roof or floor framing members, shall be stiff enough to limit the relative movement between the wall and the diaphragm to no more than 1/8" before engagement of the anchors, when subject to the wall anchorage design forces.

Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

Expansion anchors are only allowed with special inspection and *approved* testing for seismic loading.

Attaching the edge of plywood sheathing to steel ledgers is not considered compliant with the positive anchoring requirements of this chapter. Attaching the edge of steel decks to steel ledgers is not considered as providing the positive anchorage of this chapter unless testing or analysis is performed to establish shear values for the attachment perpendicular to the edge of the deck. Where steel decking is used as a wall anchor system, the existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

Exception: Existing cast-in-place shear anchors are allowed to be used as wall anchors if the tie element can be readily attached to the anchors, and if the engineer or architect can establish tension values for the existing anchors through the use of *approved* as-built plans or testing and through analysis showing that the bolts are capable of resisting the total shear load (including dead load) while being acted on by the maximum tension force caused by an earthquake. Criteria for analysis and testing shall be determined by the building official.

Reason: This proposal adds a stiffness requirement for the wall anchorage system. The proposed requirement is consistent with ASCE 41-17 Table 17-34. It has the same intent as a stiffness requirement discussed in the SEAOC commentary to IEBC Chapter A2 and implemented by the City of Los Angeles Department of Building and Safety. The SEAOC and Los Angeles approach limits the elongation under load. The ASCE 41 approach, which is the approach adopted here, limits the slack in the system (including continuity connectors along the length of the cross-ties) provided by the detailing and construction.

In addition to the proposed design criteria in Section A206.2, the proposal adds a special inspection requirement to Section A205.4 to ensure that additional slack is not introduced as continuity connectors are added to crossties.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Typical applications are expected to already satisfy the new stiffness requirement.

EB147-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

A205.4.1 Additional special inspection. In addition to the requirements of International Building Code Section 1705.12, special inspection shall be required for:

1. Installation of continuity connectors along the length of crossties, to ensure ~~properly sized fastener holes and adequate crosstie stiffness compliance with Section A206.2. This inspection may be periodic special inspection.~~

[BS] A206.2 Special requirements for wall anchorage systems. The steel elements of the wall anchorage system shall be designed in accordance with the International Building Code without the use of the 1.33 short duration allowable stress increase where using allowable stress design.

The wall anchorage system, excluding subdiaphragms and existing roof or floor framing members, shall be ~~stiff enough~~ designed and installed to limit the relative movement between the wall and the diaphragm to no more than 1/8" before engagement of the anchors, ~~when subject to the wall anchorage design forces.~~

Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

Expansion anchors are only allowed with special inspection and *approved* testing for seismic loading.

Attaching the edge of plywood sheathing to steel ledgers is not considered compliant with the positive anchoring requirements of this chapter. Attaching the edge of steel decks to steel ledgers is not considered as providing the positive anchorage of this chapter unless testing or analysis is performed to establish shear values for the attachment perpendicular to the edge of the deck. Where steel decking is used as a wall anchor system, the existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

Exception: Existing cast-in-place shear anchors are allowed to be used as wall anchors if the tie element can be readily attached to the anchors, and if the engineer or architect can establish tension values for the existing anchors through the use of *approved* as-built plans or testing and through analysis showing that the bolts are capable of resisting the total shear load (including dead load) while being acted on by the maximum tension force caused by an earthquake. Criteria for analysis and testing shall be determined by the building official.

Committee Reason: The proposal adds a necessary stiffness criteria to Chapter A2. The modifications remove redundant terms and commentary type language. (Vote: 14-0)

Assembly Action:

None

EB147-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: A205.4.1 (New)

Proponents:

Jenifer Gilliland, representing Seattle Department of Construction and Inspections (jenifer.gilliland@seattle.gov); Jonathan Siu, representing City of Seattle Department of Construction and Inspections (jon.siu@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

A205.4.1 Additional special inspection. In addition to the requirements of International Building Code Section 1705.12, special inspection shall be required for:

Installation of continuity connectors along the length of crossties, to ensure compliance with Section A206.2. This inspection ~~may be~~ shall be permitted to be periodic special inspection.

Commenter's Reason: This is an editorial modification. "May" is not mandatory code language. Adding "shall be permitted to" will align this section with the rest of the code where this phrase is used to describe circumstances not normally allowed by the code official.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The elimination of ambiguous code language in lieu of mandatory code language will not impact the cost of construction.

EB149-19

IEBC@: [BS] A206.2, [BS] A206.3

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Revise as follows:

[BS] A206.2 Special requirements for wall anchorage systems. The steel elements of the wall anchorage system shall be designed in accordance with the International Building Code without the use of the 1.33 short duration allowable stress increase where using allowable stress design.

Where new members are added as crossties, they shall be spaced no more than 24 feet (7315 mm) apart. Where existing girders are used as crossties, their actual spacing shall be deemed adequate even where the spacing exceeds 24 feet (7315 mm), as long as the girders are provided with adequate continuity connectors.

Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

Expansion anchors are only allowed with special inspection and *approved* testing for seismic loading.

Attaching the edge of plywood sheathing to steel ledgers is not considered compliant with the positive anchoring requirements of this chapter. Attaching the edge of steel decks to steel ledgers is not considered as providing the positive anchorage of this chapter unless testing or analysis is performed to establish shear values for the attachment perpendicular to the edge of the deck. Where steel decking is used as a wall anchor system, the existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

Exception: Existing cast-in-place shear anchors are allowed to be used as wall anchors if the tie element can be readily attached to the anchors, and if the engineer or architect can establish tension values for the existing anchors through the use of *approved* as-built plans or testing and through analysis showing that the bolts are capable of resisting the total shear load (including dead load) while being acted on by the maximum tension force caused by an earthquake. Criteria for analysis and testing shall be determined by the building official.

[BS] A206.3 Development of anchor loads into the diaphragm. Development of anchor loads into roof and floor diaphragms shall comply with Section 1613 of the International Building Code using horizontal forces that are 75 percent of those used for new construction.

In wood diaphragms, anchorage shall not be accomplished by use of toenails or nails subject to withdrawal. Wood ledgers, top plates or framing shall not be used in cross-grain bending or cross-grain tension. The continuous ties required in Section 1613 of the International Building Code shall be in addition to the diaphragm sheathing.

Lengths of development of anchor loads in wood diaphragms shall be based on existing field nailing of the sheathing unless existing edge nailing is positively identified on the original construction plans or at the site.

Exception: ~~If continuously tied girders are present, the maximum spacing of the continuity ties is the greater of the girder spacing or 24 feet (7315 mm).~~

Reason: This editorial proposal corrects a misplaced provision and clarifies its intent. The current exception to Section A206.3 is out of place for two reasons. First, it is unrelated to the issue of load development into the diaphragm (crossties must be continuous across the full diaphragm width), so it really belongs in Section A206.2. Second, since ASCE 7 sets no limit on the maximum spacing of crossties, the provision is not really an exception at all. Therefore, as the existing text is relocated to Section A206.2, it has been edited to clarify the intended spacing limit and the allowance where existing members act as adequate crossties.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Editorial therefore will have no impact on cost.

EB149-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal is editorial in nature whereas it relocates, from section A206.3 to A206.2, the special requirements for wall anchorages systems where new members are added as crossties. The committee urged that during the public comment phase 'girders' be changed to 'members'.

(Vote: 14-0)

Assembly Action:

None

EB149-19

Individual Consideration Agenda

Public Comment 1:

IEBC®: [BS] A206.2

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

[BS] A206.2 Special requirements for wall anchorage systems. The steel elements of the wall anchorage system shall be designed in accordance with the International Building Code without the use of the 1.33 short duration allowable stress increase where using allowable stress design.

Where new members are added as crossties, they shall be spaced no more than 24 feet (7315 mm) apart. Where existing girders are used as crossties, their actual spacing shall be deemed adequate even where the spacing exceeds 24 feet (7315 mm), as long as the girders are provided with ~~adequate~~ continuity connectors as required.

Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

Expansion anchors are only allowed with special inspection and *approved* testing for seismic loading.

Attaching the edge of plywood sheathing to steel ledgers is not considered compliant with the positive anchoring requirements of this chapter. Attaching the edge of steel decks to steel ledgers is not considered as providing the positive anchorage of this chapter unless testing or analysis is performed to establish shear values for the attachment perpendicular to the edge of the deck. Where steel decking is used as a wall anchor system, the existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

Exception: Existing cast-in-place shear anchors are allowed to be used as wall anchors if the tie element can be readily attached to the anchors, and if the engineer or architect can establish tension values for the existing anchors through the use of *approved* as-built plans or testing and through analysis showing that the bolts are capable of resisting the total shear load (including dead load) while being acted on by the maximum tension force caused by an earthquake. Criteria for analysis and testing shall be determined by the building official.

Commenter's Reason: The IBC-S committee approved EB149-19 as submitted. During testimony, however, committee members suggested that "adequate continuity connectors" could be changed to "continuity connectors as required," to make the provision more enforceable. This PC responds to that committee suggestion. (Note, the term continuity connector is now defined by proposal EB141, also approved by the committee.)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal and the PC are editorial.

Public Comment# 2137

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Delete and substitute as follows:

~~**[BS] A403.8 Horizontal diaphragms.** The strength of an existing horizontal diaphragm sheathed with wood structural panels or diagonal sheathing need not be investigated unless the diaphragm is required to transfer lateral forces from vertical elements of the seismic force-resisting system above the diaphragm to elements below the diaphragm because of an offset in placement of the elements.~~

~~Rotational effects shall be accounted for where asymmetric wall stiffness increases shear demands.~~

[BS] A403.8 Floor diaphragms. Floor diaphragms within the scope of Section A403.2 shall be shown to have adequate strength at the following locations:

1. For straight lumber sheathed diaphragms without integral hardwood flooring: Throughout the diaphragm. The code official is authorized to waive the requirement where the condition occurs only in relatively small portions of each residential unit.
2. For other diaphragms: At locations where forces are transferred between the diaphragm and a new or strengthened vertical element of the seismic force-resisting system. Collector elements may be provided to distribute the transferred force over a greater length of diaphragm.

Exception: Where the existing vertical elements of the seismic force-resisting system are shown to comply with this chapter, diaphragms need not be evaluated.

Reason: This proposal clarifies the chapter's intent regarding the need for diaphragm strengthening. The current provision focuses on locations where the walls above and below the diaphragm are offset from each other, but this can be read improperly to mean the entire diaphragm since a lack of stacked walls in the lower story is typically what makes a building a candidate for Chapter A4. Instead, the focus should be on proper force transfer between the critical diaphragm and the new or existing wall lines below.

The proposal implements a recommendation by the Structural Engineers Association of Northern California Existing Buildings Committee that has already been adopted by retrofit programs affecting thousands of buildings in San Francisco, Berkeley, and Oakland, California.

The proposal recognizes that diaphragms are rarely the critical elements in these buildings. In many cases, the proposed requirement will require less work than the current provision. This is appropriate for the limited objective of Chapter A4.

The proposal also adds clarity by stating requirements for vulnerable diaphragm types that the current provision only implies.

Straight lumber sheathed diaphragms without integral hardwood flooring are weaker and more flexible than other diaphragm systems. Though there are no known collapses due to this condition, expected poor performance could compromise the building's ability to meet even the limited objective of Chapter A4. Integral hardwood flooring – but not newer “floating” wood flooring – provides significant added strength and stiffness. Even in buildings with original hardwood flooring, some remodeled, carpeted, or tiled areas might have had the original wood flooring removed. Areas of the diaphragm that form a roof for the critical story (such as the portion of a garage that extends beyond the wall line above, or at a lightwell or building setback) are also unlikely to have hardwood flooring to supplement the straight sheathing. Small isolated areas without hardwood flooring are not expected to affect overall building performance, so the provision grants a waiver for these cases.

For less vulnerable diaphragm types, the provision requires a local check for each new or strengthened SFRS element but does not require an overall analysis of the full diaphragm. Diaphragm capacity need not be checked at existing vertical elements that are not strengthened because (except for straight lumber sheathed diaphragms) it is assumed that the unit capacities of the existing vertical elements and the diaphragm are comparable.

The exception waives any retrofit of the diaphragms if the existing walls and frames are already found adequate.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. In some cases, it could decrease the cost of construction as it may require less work than the current provisions.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

[BS] A403.8 Floor diaphragms. Floor diaphragms within the scope of Section A403.2 shall be shown to have adequate strength at the following locations:

1. For straight lumber sheathed diaphragms without integral hardwood flooring: Throughout the diaphragm. The code official is authorized to waive the requirement where the condition occurs only in relatively small portions of each residential unit.
2. For all other diaphragms: At locations where forces are transferred between the diaphragm and ~~a~~ each new or strengthened vertical element of the seismic force-resisting system. Collector elements ~~may~~ shall be provided where needed to distribute the transferred force over a greater length of diaphragm.

Exception: Where the existing vertical elements of the seismic force-resisting system are shown to comply with this chapter, diaphragms need not be evaluated.

Committee Reason: This proposal clarifies the chapter's intent regarding the need for diaphragm strengthening. The current provision focuses on locations where the walls above and below the diaphragm are offset from each other, but this can be read improperly to mean the entire diaphragm since a lack of stacked walls in the lower story is typically what makes a building a candidate for Chapter A4. Instead, the focus should be on proper force transfer between the critical diaphragm and the new or existing wall lines below. The proposal implements a recommendation by the Structural Engineers Association of Northern California Existing Buildings Committee that has already been adopted by retrofit programs affecting thousands of buildings in San Francisco, Berkeley, and Oakland, California. The modifications makes editorial revisions to clarify the application of the section. The committee requests a public comment to address unenforceable language such as "in relatively small portions." (Vote: 14-0)

Assembly Action:

None

EB161-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: [BS] A403.8

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Existing Building Code

[BS] A403.8 Floor diaphragms. Floor diaphragms within the scope of Section A403.2 shall be shown to have adequate strength at the following locations:

1. For straight lumber sheathed diaphragms without integral hardwood flooring Throughout the diaphragm. The code official is authorized to waive the requirement where it is shown that the condition occurs in areas small enough not to affect overall building performance ~~only in relatively small portions of each residential unit.~~
2. For all other diaphragms: At locations where forces are transferred between the diaphragm and each new or strengthened vertical element of the seismic force-resisting system. Collector elements shall be provided where needed to distribute the transferred force over a greater length of diaphragm.

Exception: Where the existing vertical elements of the seismic force-resisting system are shown to comply with this chapter, diaphragms need not be evaluated.

Commenter's Reason: The IBC-S committee approved this proposal as a valuable improvement already adopted in several jurisdictions. As noted

in the committee's reason, however, members suggested revising some of the wording to make the provision more enforceable. This proposal accepts that suggestion and uses wording offered by a committee member consistent with the proposal's reason statement. By saying "where it is shown," the provision now provides a mechanism for justifying the waiver, requiring the engineer of record to provide reasoning.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As with the original proposal, the proposal modified by public comment is intended only to clarify the current requirements but could, in some cases, actually reduce the cost of design and construction.

Public Comment# 2138

EB163-19

IEBC@: A403.10 (New), A403.10.1 (New), A403.10.2 (New), A403.10.3 (New), A403.10.4 (New), AISC (New)

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Add new text as follows:

A403.10 Steel retrofit systems. Steel retrofit systems shall have strength and stiffness sufficient to resist the seismic loads and shall conform to the requirements of this section.

A403.10.1 Special moment frames. Steel special moment frames shall comply with all applicable provisions of AISC 341, except that the “strong-column/weak-beam” provision of AISC 341-10, Section E3.4a is waived for columns that carry no gravity load. Proprietary frame systems that qualify as special moment frames shall be permitted.

A403.10.2 Intermediate or ordinary moment frames. Steel intermediate or ordinary moment frames shall comply with all applicable provisions of AISC 341.

A403.10.3 Cantilevered column systems. Steel special or ordinary cantilevered column systems shall comply with all applicable provisions of AISC 341.

A403.10.4 Inverted moment frame systems. Cantilevered column systems shall be permitted to be designed as inverted special, intermediate, or ordinary moment frames, with corresponding moment frame seismic design coefficients, where the system satisfies the following conditions:

1. The columns carry no gravity load.
2. The columns are configured in pairs or larger groups connected by a continuous reinforced concrete foundation or grade beam.
3. The foundation or grade beam shall be designed to resist the expected plastic moment at the base of each column, computed as $R_v F_y Z$ in accordance with AISC 341.
4. The flexibility of the foundation or grade beam, considering cracked section properties of the reinforced concrete, shall be included in computing the deformation of the steel frame system.
5. The column height shall be taken as twice the actual height when checking lateral torsional buckling.

Add new standard(s) as follows:

AISC

American Institute of Steel Construction
Construction One East Wacker, Suite 700
Chicago IL 60601-18021
US

341-16: Seismic Provisions for Structural Steel Buildings

Reason: This proposal adds details for structural systems commonly used in Chapter A4 retrofits. The proposal implements a recommendation by the Structural Engineers Association of Northern California Existing Buildings Committee that has already been adopted by retrofit programs affecting thousands of buildings in San Francisco, Berkeley, and Oakland, California.

The inverted moment frame (proposed Section A403.10.4) is a modification of traditional cantilevered column systems. Cantilevered column systems for new construction are normally assigned seismic design coefficients that severely limit their use. When used for retrofit of wood frame structures, however, the columns are less vulnerable to buckling failure because they carry no gravity load. SEAONC EBC has therefore recommended that these cantilever column systems, configured as upside-down moment frame bents (with concrete cross beams), should be allowed to be designed as moment frame systems.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal merely codifies typical practices already in use and shown to be feasible.

Staff Analysis: Note that AISC 341 is new to the IEBC but is currently referenced in the IBC.

EB163-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

A403.10.1 Special moment frames. Steel special moment frames shall comply with all applicable provisions of AISC 341, except that the "strong-column/weak-beam" provision of AISC 341-10, Section E3.4a is waived for columns that carry no gravity load. Proprietary frame systems that qualify as special moment frames shall be permitted.

Committee Reason: The committee agreed with the proponents reason statement. The editorial modification removes the year from the AISC 341 reference as the year is included in Chapter 35 listing the reference standards. (Vote: 14-0)

Assembly Action:

None

EB163-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: A403.10 (New), A403.10.1 (New), A403.10.2 (New), A403.10.3 (New), AISC (New)

Proponents:

Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Jonathan Siu, representing City of Seattle Department of Construction and Inspections (jon.siu@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

A403.10 Steel retrofit systems. Steel retrofit systems shall have strength and stiffness sufficient to resist the seismic loads and shall conform to the requirements of this section.

A403.10.1 Special moment frames. Steel special moment frames shall comply with all applicable provisions of AISC 341, except that the "strong-column/weak-beam" provision of AISC 341, Section E3.4a is waived for columns that carry no gravity load. ~~Proprietary frame systems that qualify as special moment frames shall be permitted.~~

~~**A403.10.2 Intermediate or ordinary moment frames.** Steel intermediate or ordinary moment frames shall comply with all applicable provisions of AISC 341.~~

~~**A403.10.3 Cantilevered column systems.** Steel special or ordinary cantilevered column systems shall comply with all applicable provisions of AISC 341.~~

~~**A403.10.4**~~ **A403.10.2 Inverted moment frame systems.** Cantilevered column systems shall be permitted to be designed as inverted special, intermediate, or ordinary moment frames, with corresponding moment frame seismic design coefficients, where the system satisfies the following conditions:

1. The columns carry no gravity load.
2. The columns are configured in pairs or larger groups connected by a continuous reinforced concrete foundation or grade beam.
3. The foundation or grade beam shall be designed to resist the expected plastic moment at the base of each column, computed as $R_y F_y Z$ in accordance with AISC 341.
4. The flexibility of the foundation or grade beam, considering cracked section properties of the reinforced concrete, shall be included in computing the deformation of the steel frame system.
5. The column height shall be taken as twice the actual height when checking lateral torsional buckling.

AISC

American Institute of Steel Construction
Construction One East Wacker, Suite 700
Chicago IL 60601-18021
US

341-16: Seismic Provisions for Structural Steel Buildings

Commenter's Reason: We support the technical content in the original proposal. This public comment removes unnecessary code language referenced elsewhere in the code as well as addresses the concern of creating incomplete lists.

ASCE 7 and AISC 341 are adopted reference standards in the IBC with clearly defined and acceptable steel lateral force-resisting systems. There is no need to add code language to point to what are already allowable steel lateral force-resisting systems. We understand the proponent's desire to clarify that proprietary special moment frames, intermediate or ordinary moment frames, and cantilevered column systems can be used with no further requirements or exceptions. However, these systems are already allowed by code. In addition, by listing a limited number of code allowed steel lateral force-resisting systems engineers or building officials may misinterpret as only those systems listed may be used. What about steel concentrically braced frames or steel buckling-restrained braced frames? Incomplete lists can unintentionally be limiting and should be avoided.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment removes language contained in other code sections and eliminates language that could be mistakenly used as an incomplete list. Neither of these changes result in a cost impact.

Public Comment# 1865

EB164-19

IEBC@: SECTION A406, [BS] A406.1

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Existing Building Code

Revise as follows:

SECTION A406 **INFORMATION REQUIRED TO BE ON THE PLANS CONSTRUCTION DOCUMENTS**

[BS] A406.1 General. The plans shall show all information necessary for plan review and for construction ~~and~~, shall accurately reflect the results of the ~~engineering investigation and design~~ design, and shall otherwise comply with all requirements established by the code official. The plans shall contain a note that states that this retrofit was designed in compliance with the criteria of this chapter.

Reason: This proposal revises the Chapter A4 administrative requirements to better align with IEBC Section 106 and with practices already adopted by the local building department.

The reference to "engineering investigation" is removed to avoid confusion (Chapter A4 does not explicitly require any such investigation) and because the "design" should already account for existing conditions, which are required to be documented per Section A406.2.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal is consistent with Section 106 and is also consistent with local building department practices and therefore will not have an effect on cost.

EB164-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The proposal was approved based upon the proponents reason statement. Additionally, the revisions delete unnecessary requirements for field investigation notes on the drawings.

(Vote: 11-3)

Assembly Action:

None

EB164-19

Individual Consideration Agenda

Public Comment 1:

IEBC@: [BS] A406.1

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Existing Building Code

[BS] A406.1 General. The plans shall show all information necessary for plan review and for construction; and shall accurately reflect the results of

the design, ~~and shall otherwise comply with all requirements established by the code official.~~ The plans shall contain a note that states that this retrofit was designed in compliance with the criteria of this chapter.

Commenter's Reason: The IBC-S committee approved EB164 as submitted. During testimony, however, some committee members questioned the referent of the proposed word "otherwise," some suggested that the phrase involving that word is unnecessary, and some suggested that the "otherwise" phrase is actually an important part of the proposal.

Everyone, however, agreed (as the committee's reason statement says) that the proposal is valuable for removing an improper and confusing requirement regarding whether to put engineering investigation findings on the plans (especially since IEBC Chapter A4 does not require an engineering investigation). Therefore, this comment is meant to focus on the portion that everyone agreed on, and give the ICC members a choice between the proposal as submitted and the proposal as modified by this comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Same as the original proposal.

Public Comment# 2141

G2-19

IBC@: [BS] 202; IEBC@: [BS] 202

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

THIS CODE CHANGE WILL BE HEARD BY THE IBC-STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE

2018 International Building Code

Revise as follows:

[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgment of any portion, member, appurtenance or ornamentation of the building or structure under ~~service loads~~ permanent, routine, or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake, or other environmental loads when such loads are imminent.

2018 International Existing Building Code

Revise as follows:

[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation, or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgment of any portion, member, appurtenance or ornamentation of the building or structure under ~~service loads~~ permanent, routine, or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake, or other environmental loads when such loads are imminent.

Reason: This proposal solves a problem with the definition of Dangerous going back to 2010. This proposal presents the consensus of the proponents, the IBC-S committee, and the Public Comment voters regarding proposal G4-16 in the last cycle.

The problem involves the words "service loads" in the current definition. With IBC Interpretation 23-10 (issued 12/8/2010), ICC interpreted "service loads" to be the same as "nominal" or unfactored loads, but this is incorrect and contrary to the intent of the definition when it was written.

In the last cycle, the IBC-S committee deliberated over a number of ways to clarify the intent and settled on the best solution: simply to remove the words "service loads" and replace them with the text shown here. This solution avoids any conflict with definitions or interpretations of "service loads" in other codes or standards. With this consensus, the IBC-S committee Disapproved G4 and asked the proponent to revise the proposal accordingly with a public comment.

At the PCH, G4-16 was easily approved as modified (and as shown here) by a show of hands. 58% of OGV voters supported the modified proposal, but since the PCH hand votes could not be added, the OGV vote fell short of the 2/3 requirement, and the clear consensus from the IBC-S committee, the proponent, and the PCH voters could not be approved.

For those concerned about interpretation of any of the new text, note: 1. This issue was already considered by IBC-S and by the PCH voters, who approved the text as shown. 2. The CURRENT definition already includes wording -- "necessary support," "significant risk" -- that requires some interpretation and judgment. 3. The whole purpose of this definition, as documented clearly in the reason statements when the definition was changed several cycles ago, is to give discretion to the code official and to rely on the code official's judgment, so that a designation of dangerous, and protection of the public, need not wait for the results of a quantitative test or analysis.

Bibliography: IBC Interpretation 23-10 is available at https://www2.iccsafe.org/cs/committeeArea/pdf_file/EB_09_23_10.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal merely clarifies the current code intent.

G2-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal solves a problem with the definition of Dangerous going back to 2010. This proposal presents the consensus of the proponents, the IBC-S committee, and the Public Comment voters regarding proposal G4-16 in the last cycle. The problem involves the words "service loads" in the current definition. With IBC Interpretation 23-10 (issued 12/8/2010), ICC interpreted "service loads" to be the same as "nominal" or unfactored loads, but this is incorrect and contrary to the intent of the definition when it was written. (Vote: 14-0)

Assembly Action:

None

G2-19

Individual Consideration Agenda

Public Comment 1:

IBC®: [BS] 202; IEBC®: [BS] 202

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgment of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine, or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake, or other environmental loads, when any such loads are imminent.

2018 International Existing Building Code

[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation, or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgement of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine, or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake, or other environmental loads, when any such loads are imminent.

Commenter's Reason: The IBC-S committee unanimously approved G2 as submitted, referencing a broad consensus developed over the past several cycles. During testimony, one committee member suggested that the meaning of the final phrase could be clarified by adding a comma to clarify that "such loads" refers to all of the load types covered in the proposal's final phrase (snow, wind, etc.), and not just the immediate antecedent, "other environmental loads."

This comment implements that suggestion.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal merely clarifies the current code intent.

Public Comment# 2144

G10-19

IBC: [BS] 202

Proposed Change as Submitted

Proponents: Kristen Owen, Consultant, representing Self (kowen4568@gmail.com)

THIS CODE CHANGE WILL BE HEARD BY THE IBC-STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE

2018 International Building Code

Revise as follows:

[BS] TREATED WOOD. ~~Wood products that are conditioned to enhance fire-retardant or preservative properties.~~ modified to reduce deterioration and destruction by wood destroying organisms and fire .

Reason: The word "conditioned" in the current definition does not relate to Treated Wood. "Conditioned" references moisture control which is not part of the definition of Treated Wood.

This Code change proposal reflects a clearer definition of Treated Wood and brings the Code up to date by the inclusion of newer standards in the referenced American Wood Protection Association Standards.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a definition change only and therefore no cost change to construction.

G10-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposed code change does not improve upon the current definition.
(Vote: 13-1)

Assembly Action:

None

G10-19

Individual Consideration Agenda

Public Comment 1:

IBC@: [BS], 202 (New)

Proponents:

Paul Coats, representing American Wood Council (pcoats@awc.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

[BS] TREATED WOOD. ~~Wood products that are conditioned to enhance fire-retardant or preservative properties.~~

FIRE-RETARDANT-TREATED WOOD. Wood products meeting the requirements of Section 2303.2 that exhibit reduced surface-burning characteristics and resist propagation of fire.

PRESERVATIVE-TREATED WOOD. Wood products meeting the requirements of Section 2303.1.9 that exhibit reduced susceptibility to damage by fungi, insects or marine borers.

Commenter's Reason: Terms in the current definition have become the subject of debate because they may not accurately describe treated wood in all potential code applications. Simply referring to the respective code sections will safeguard the definitions from inconsistency with the code requirements.

A general definition of "treated wood" is unnecessary since the code always qualifies the term "treated" with one of the two terms (fire-retardant-treated or preservative-treated). This code change deletes the general definition for treated wood and elevates the current sub-definitions to general definitions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. It will have no impact on cost.

Public Comment# 1586

Public Comment 2:

IBC@: [BS], 202 (New)

Proponents:

Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

~~[BS] TREATED WOOD. Wood products that are conditioned to enhance fire-retardant or preservative properties.~~

FIRE-RETARDANT-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.

PRESERVATIVE-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced susceptibility to damage by fungi, insects or marine borers.

Commenter's Reason: This public comment deletes the definition of treated wood, which is unnecessary, and replaces it by two separate, stand-alone, definitions of "fire-retardant-treated wood" and "preservative-treated wood". Throughout the code, the terms actually used are the separate definitions. In fact, there are two examples of the use of "untreated wood" and in both cases, the context explains what is meant. In 705.2.3.1 it means non fire-retardant wood and treated wood and in 2304.1.2.3 it means non preservative treated wood. The definition of treated wood tries to cover both aspects but fails to do so properly. In particular, it does not clarify that a key issue for use in the code is that it should be treated during manufacturing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code proposal deals with definitions only and is clarification.

Public Comment# 1457

Public Comment 3:

IBC@: [BS], 202 (New)

Proponents:

Kristen Owen, representing Kris Owen Consultant (kowen4568@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

~~[BS] TREATED WOOD. Wood products that are conditioned to enhance fire-retardant or preservative properties.~~

~~**Fire-retardant-treated wood.** Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.~~

~~**Preservative-treated wood:** Wood products that, conditioned with chemicals by a pressure process or other means, exhibit reduced susceptibility to damage by fungi, insects or marine borers.~~

FIRE-RETARDANT-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.

PRESERVATIVE -TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced susceptibility to fungi, insects and marine borers.

Commenter's Reason: Since the term "Treated Wood" is not used in the IBC, there is no need for the term to be defined. However, the terms "Fire-retardant-treated wood" and "Preservative-treated wood" are used in many locations. This change will correctly define both terms and allow them to be placed in their correct location in Definitions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no increase or decrease to the cost of construction as a result of this public comment and code change.

Public Comment# 1465

G12-19 Part I

IBC®: [BS] 202

Proposed Change as Submitted

Proponents: Don Scott, Representing National Council of Structural Engineers Association, representing Representing National Council of Structural Engineers Association (dscott@pcs-structural.com)

THIS IS A TWO PART PROPOSAL. PART I WILL BE HEARD BY THE IBC-STRUCTURAL COMMITTEE. PART II WILL BE HEARD BY THE IRC-BUILDING COMMITTEE. PLEASE CHECK THE RESPECTIVE HEARING AGENDAS.

2018 International Building Code

Revise as follows:

[BS] WINDBORNE DEBRIS REGION. Areas within hurricane-prone regions located:

1. Within 1 mile (1.61 km) of the ~~coastal~~ mean high-water line, where an Exposure D condition exists upwind at the waterline and the basic design wind speed, V , is 130 mph (58 m/s) or greater; or
2. In areas where the basic design wind speed is 140 mph (63.6 m/s) or greater.

For *Risk Category* II buildings and structures and *Risk Category* III buildings and structures, except health care facilities, the windborne debris region shall be based on Figure 1609.3.(1). For *Risk Category* IV buildings and structures and *Risk Category* III health care facilities, the windborne debris region shall be based on Figure 1609.3(2).

Reason: Significant confusion has arisen in hurricane-prone regions in trying to determine windborne debris regions because the term "coastal mean high waterline" is not a mapped or defined term. Due to this lack of definition, some jurisdictions have incorrectly interpreted areas within one mile of the mean high waterline along narrow inland tidal waterways to be in windborne debris regions. The primary intent behind paragraph No. 1, is that within one mile of the coast, hurricane wind speeds will be governed by the wind speed over the open water, i.e. an Exposure Category D rather than an inland Exposure Category C situation on which the basic wind speed and paragraph No. 2 are based. This CCP clarifies that the waterline has to be classified as an Exposure D in order for paragraph No. 1 to apply. It also deletes the word "coastal" since wind speed increases could occur at large inland waterways in hurricane-prone regions as well. Also, NOAA maintains a database of the "mean high waterline" values in the US, which can be used in conjunction with this definition.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code change proposal is location dependent on its impact on construction costs, however by providing a definition of the windborne debris zone, it will eliminate confusion as to where to apply the windborne debris protection requirements.

G12-19 Part I

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The proposal eliminates the undefined term 'coastal', and the committee action is consistent with the action taken on Part II. (Vote: 14-0)

Assembly Action:

None

G12-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests Disapprove

Commenter's Reason: The purpose of this public comment is to urge disapproval of the proposed change to the wind-borne debris trigger. Contrary to the proponent's reason statement, this is a significant change that will cause more confusion than it eliminates and greatly expand where wind-borne debris protection is required.

The use of the word "coastal" in the current 130 mph trigger for wind-borne debris protection clearly implies an intent to trigger protection for sites near open water such as the Atlantic Ocean or the Gulf of Mexico. The current 130 mph trigger would not apply to water bodies such as fully landlocked lakes or rivers that do not feed directly into the ocean. It would not even apply to rivers that **do** open to the ocean if the shorelines of such rivers are more than one mile from the mean high-water line at the actual coast.

However, many such lakes or rivers are more than a mile wide in at least one direction and a site located upwind of that direction could be classified as Exposure D. Therefore, the proposed revision would in fact appear to capture sites near the shorelines of large inland lakes or wide rivers (whether open to the ocean or not) if the wind speed at the site also equals or exceeds 130 mph. Sites along wide bays and estuaries that are more than a mile from where such features open to the ocean or Gulf would also be captured.

A close examination of the 130-mph wind contour for Risk Category II buildings (the category that covers dwellings and most multifamily construction) identified several areas for which the revised definition would potentially trigger wind-borne debris protection where it is not already required. Notable examples include the following:

- Narraganset Bay and the Sakonnet River in RI near Providence, RI
- Shinnecock Bay on Long Island (Hampton Bays, Shinnecock Hills, East Quogue)
- Lake Mattamuskeet in Hyde County, North Carolina
- White Lake in Bladen County, North Carolina
- Lakes Moultrie and Marion in South Carolina
- Lake Houston northwest of Houston (near Atascocita)
- Lake Corpus Christi northwest of Corpus Christi

However, these areas, or similar areas, have not necessarily experienced widespread wind-borne debris damage in hurricanes. For example, sites where FEMA's MAT report on Hurricane Harvey specifically documented wind-borne debris impacts were in areas where the wind speed per the 2009 IRC and ASCE 7-05 (the locally-adopted editions at the time) required protection regardless of the proximity to the coast. Many of the sites were also within one mile of the Gulf of Mexico, so protection would be required even under the current coastal mean high-water line trigger. Similarly, where the Irma MAT report documented wind-borne debris damage in Ramrod and Little Torch Key, protection is already required based on the design wind speed and again, most of the area of both islands could be considered "within one mile of the coastal mean high-water line".

Even in Hurricane Katrina, wind-borne debris damage around Lake Pontchartrain (which is technically an estuary rather than an inland lake) was limited to specific conditions. The FEMA and NIST reports did not document wind-borne debris damage in areas such as Laplace, Madisonville, Mandeville and Lacombe, which all lie near where the 130 mph wind contour crosses Lake Pontchartrain. Reported wind-borne debris damage from Katrina primarily occurred in urban areas (e.g. downtown New Orleans) or suburban commercial areas (e.g. Slidell) where blow-off from aggregate roofs occurred, or in areas along the actual Gulf coastline where wind-borne debris protection would be required anyway as the ultimate wind speed is 140mph or higher.

The source of the change stems from discussions within the ASCE 7 committee over a request for interpretation. A corresponding change is being considered for the 2022 edition of ASCE 7, but as of the ICC public comment deadline balloting at the ASCE Wind Load Subcommittee (WLSC) level was not even complete. It is possible that based on responses to the WLSC ballot and (assuming the proposal advances) responses to Main Committee ballots, the eventual ASCE 7-22 language may have additional qualifiers or clarifications. Given the significant cost impacts that can result if impact-resistant glazing or impact-protective systems are required, it would be irresponsible for the I-Codes to get out in front of ASCE 7 and impose a huge unfunded mandate on the construction industry for limited benefit.

The Home Innovation Research Lab calculated the cost impact for installing common methods of wind-borne debris protection on a typical home with 360 square feet of glazing. The added cost was around \$1,800 a home if wood structural panels are used, \$3,400 if manually-operated hurricane shutters are used, and \$9,600 if impact-resistant glazing is provided.

Contrary to the proponent's statement the proposed revision will not increase the cost of construction, these are clearly significant impacts that can price thousands of people in an area out of a new home. This negative impact on affordability is particularly concerning where the revised definition may impact a small, rural, lower-income community that may be miles from the Atlantic or Gulf coast but just happens to be adjacent to a lake or river large enough to trigger Exposure D conditions. Homebuyers and renters in these communities or other communities impacted by this change may find themselves only able to afford older, existing houses that were not built to any edition of the IRC and are significantly less resistant to a variety of hazards than newer homes.

Bibliography: FEMA 549 - Mitigation Assessment Team Report - *Hurricane Katrina in the Gulf Coast* (July 2006).
FEMA P-2022 - Mitigation Assessment Team Report - *Hurricane Harvey in Texas* (March 2019).

FEMA P-2023 - Mitigation Assessment Team Report - *Hurricane Irma in Florida* (December 2018).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1487

G12-19 Part II

IRC: [RB]202

Proposed Change as Submitted

Proponents: Don Scott, Representing National Council of Structural Engineers Association, representing Representing National Council of Structural Engineers Association (dscott@pcs-structural.com)

2018 International Residential Code

[RB] WINDBORNE DEBRIS REGION. Areas within *hurricane-prone regions* located in accordance with one of the following:

1. Within 1 mile (1.61 km) of the ~~coastal~~ mean high-water line where an Exposure D condition exists upwind at the waterline and the ultimate design wind speed, V_{ult} , is 130 mph (58 m/s) or greater.

2. In areas where the ultimate design wind speed, V_{ult} , is 140 mph (63.6 m/s) or greater; or Hawaii.

Reason: Significant confusion has arisen in hurricane-prone regions in trying to determine windborne debris regions because the term "coastal mean high waterline" is not a mapped or defined term. Due to this lack of definition, some jurisdictions have incorrectly interpreted areas within onemile of the mean high waterline along narrow inland tidal waterways to be in windborne debris regions. The primary intent behind paragraph No. 1, is that within one mile of the coast, hurricane wind speeds will be governed by the wind speed over the open water, i.e. an Exposure Category D rather than an inland Exposure Category C situation on which the basic wind speed and paragraph No. 2 are based. This CCP clarifies that the waterline has to be classified as an Exposure D in order for paragraph No. 1 to apply. It also deletes the word "coastal" since wind speed increases could occur at large inland waterways in hurricane-prone regions as well. Also, NOAA maintains a database of the "mean high waterline" values in the US, which can be used in conjunction with this definition.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal is location dependent on its impact on construction costs, however by providing a definition of the windborne debris zone, it will eliminate confusion as to where to apply the windborne debris protection requirements.

G12-19 Part II

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Provides for exposure D in hurricane prone regions and areas where there is water. Outside of coastal areas you are out of hurricane prone regions. The committee agrees with removal of the word "coastal" as it is not a mapped or defined term. This more clearly indicates that we are talking about the water line and exposure D at the water line. (Vote: 8-3)

Assembly Action:

None

G12-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests Disapprove

Commenter's Reason: The purpose of this public comment is to urge disapproval of the proposed change to the wind-borne debris trigger. Contrary to the proponent's reason statement, this is a significant change that will cause more confusion than it eliminates and greatly expand where wind-borne debris protection is required.

The use of the word "coastal" in the current 130 mph trigger for wind-borne debris protection clearly implies an intent to trigger protection for sites near open water such as the Atlantic Ocean or the Gulf of Mexico. The current 130 mph trigger would not apply to

water bodies such as fully landlocked lakes or rivers that do not feed directly into the ocean. It would not even apply to rivers that **do** open to the ocean if the shorelines of such rivers are more than one mile from the mean high-water line at the actual coast.

However, many such lakes or rivers are more than a mile wide in at least one direction and a site located upwind of that direction could be classified as Exposure D. Therefore, the proposed revision would in fact appear to capture sites near the shorelines of large inland lakes or wide rivers (whether open to the ocean or not) if the wind speed at the site also equals or exceeds 130 mph. Sites along wide bays and estuaries that are more than a mile from where such features open to the ocean or Gulf would also be captured.

A close examination of the 130-mph wind contour for Risk Category II buildings (the category that covers dwellings and most multifamily construction) identified several areas for which the revised definition would potentially trigger wind-borne debris protection where it is not already required. Notable examples include the following:

- Narraganset Bay and the Sakonnet River in RI near Providence, RI
- Shinnecock Bay on Long Island (Hampton Bays, Shinnecock Hills, East Quogue)
- Lake Mattamuskeet in Hyde County, North Carolina
- White Lake in Bladen County, North Carolina
- Lakes Moultrie and Marion in South Carolina
- Lake Houston northwest of Houston (near Atascocita)
- Lake Corpus Christi northwest of Corpus Christi

However, these areas, or similar areas, have not necessarily experienced widespread wind-borne debris damage in hurricanes. For example, sites where FEMA's MAT report on Hurricane Harvey specifically documented wind-borne debris impacts were in areas where the wind speed per the 2009 IRC and ASCE 7-05 (the locally-adopted editions at the time) required protection regardless of the proximity to the coast. Many of the sites were also within one mile of the Gulf of Mexico, so protection would be required even under the current coastal mean high-water line trigger. Similarly, where the Irma MAT report documented wind-borne debris damage in Ramrod and Little Torch Key, protection is already required based on the design wind speed and again, most of the area of both islands could be considered "within one mile of the coastal mean high-water line".

Even in Hurricane Katrina, wind-borne debris damage around Lake Pontchartrain (which is technically an estuary rather than an inland lake) was limited to specific conditions. The FEMA and NIST reports did not document wind-borne debris damage in areas such as Laplace, Madisonville, Mandeville and Lacombe, which all lie near where the 130 mph wind contour crosses Lake Pontchartrain. Reported wind-borne debris damage from Katrina primarily occurred in urban areas (e.g. downtown New Orleans) or suburban commercial areas (e.g. Slidell) where blow-off from aggregate roofs occurred, or in areas along the actual Gulf coastline where wind-borne debris protection would be required anyway as the ultimate wind speed is 140mph or higher.

The source of the change stems from discussions within the ASCE 7 committee over a request for interpretation. A corresponding change is being considered for the 2022 edition of ASCE 7, but as of the ICC public comment deadline balloting at the ASCE Wind Load Subcommittee (WLSC) level was not even complete. It is possible that based on responses to the WLSC ballot and (assuming the proposal advances) responses to Main Committee ballots, the eventual ASCE 7-22 language may have additional qualifiers or clarifications. Given the significant cost impacts that can result if impact-resistant glazing or impact-protective systems are required, it would be irresponsible for the I-Codes to get out in front of ASCE 7 and impose a huge unfunded mandate on the construction industry for limited benefit.

The Home Innovation Research Lab calculated the cost impact for installing common methods of wind-borne debris protection on a typical home with 360 square feet of glazing. The added cost was around \$1,800 a home if wood structural panels are used, \$3,400 if manually-operated hurricane shutters are used, and \$9,600 if impact-resistant glazing is provided.

Contrary to the proponent's statement the proposed revision will not increase the cost of construction, these are clearly significant impacts that can price thousands of people in an area out of a new home. This negative impact on affordability is particularly concerning where the revised definition may impact a small, rural, lower-income community that may be miles from the Atlantic or Gulf coast but just happens to be adjacent to a lake or river large enough to trigger Exposure D conditions. Homebuyers and renters in these communities or other communities impacted by this change may find themselves only able to afford older, existing houses that were not built to any edition of the IRC and are significantly less resistant to a variety of hazards than newer homes.

Bibliography: FEMA 549 - Mitigation Assessment Team Report - *Hurricane Katrina in the Gulf Coast* (July 2006).

FEMA P-2022 - Mitigation Assessment Team Report - *Hurricane Harvey in Texas* (March 2019).

FEMA P-2023 - Mitigation Assessment Team Report - *Hurricane Irma in Florida* (December 2018).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to

code.

G13-19

IBC: [BS] 403.2.3.1, [BS] 403.2.3.2, [BS] 403.2.3.4

Proposed Change as Submitted

Proponents: Michael Schmeida, Gypsum Association, representing Gypsum Association

THIS CODE CHANGE WILL BE HEARD BY THE IBC-STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE

2018 International Building Code

[BS] 403.2.3 Structural integrity of interior exit stairways and elevator hoistway enclosures. For *high-rise buildings of Risk Category III or IV* in accordance with Section 1604.5, and for all buildings that are more than 420 feet (128 m) in *building height*, enclosures for *interior exit stairways* and elevator hoistway enclosures shall comply with Sections 403.2.3.1 through 403.2.3.4.

Revise as follows:

[BS] 403.2.3.1 Wall assembly materials - Soft Body Impact. The ~~wall assemblies panels~~ making up the enclosures for *interior exit stairways* and elevator hoistway enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.3.2 Wall assembly materials - Hard Body Impact. The ~~face of the wall assemblies panels~~ making up the enclosures for *interior exit stairways* and elevator hoistway enclosures that are not exposed to the interior of the enclosures for *interior exit stairways* or elevator hoistway enclosure shall be ~~constructed~~ in accordance with one of the following ~~methods~~:

1. The wall assembly shall incorporate ~~not no~~ fewer than two layers of impact-resistant ~~construction board panels~~, each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate ~~not no~~ fewer than one layer of impact-resistant ~~construction material panels~~ that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.3.3 Concrete and masonry walls. Concrete or masonry walls shall be deemed to satisfy the requirements of Sections 403.2.3.1 and 403.2.3.2.

Revise as follows:

[BS] 403.2.3.4 Other wall ~~assemblies materials~~. Any other wall ~~assembly materials~~ that ~~provides provide~~ impact resistance equivalent to that required by Sections 403.2.3.1 and 403.2.3.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

Reason: This clarifies that it is the wall panel/material that is tested per C1629/C1629M and not a full wall assembly. Full wall assembly testing is outside of the scope of C1629/C1629M. Section 1.1.1 of C1629/C1629M states, "panel product performance is not intended to classify the system for abuse resistance."

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is simply a clarification of the application of C1629/C1629M

G13-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This clarifies that it is the wall panel/material that is tested per C1629/C1629M and not a full wall assembly. Full wall assembly testing is outside of the scope of C1629/C1629M. Section 1.1.1 of C1629/C1629M states, "panel product performance is not intended to classify the system for abuse resistance."

(Vote: 13-1)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: [BS] 403.2.3, [BS] 403.2.3.1, [BS] 403.2.3.2, [BS] 403.2.3.3, [BS] 403.2.3.4

Proponents:

Tom Zaremba, representing Glazing Industry Code Committee (GICC), a section of the National Glass Association (NGA) (tzaremba@ralaw.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

[BS] 403.2.3 Structural integrity of interior exit stairways and elevator hoistway enclosures. For *high-rise buildings of Risk Category III or IV* in accordance with Section 1604.5, and for all buildings that are more than 420 feet (128 m) in *building height*, enclosures for *interior exit stairways* and elevator hoistway enclosures shall comply with Sections 403.2.3.1 through 403.2.3.4.

[BS] 403.2.3.1 Wall assembly materials - Soft Body Impact. The panels making up the enclosures for *interior exit stairways* and elevator hoistway enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.3.2 Wall assembly materials - Hard Body Impact. The panels making up the enclosures for *interior exit stairways* and elevator hoistway enclosures that are not exposed to the interior of the enclosures for *interior exit stairways* or elevator hoistway enclosure shall be in accordance with one of the following :

1. The wall assembly shall incorporate no fewer than two layers of impact-resistant panels, each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate no fewer than one layer of impact-resistant panels that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.3.3 Concrete, ~~and masonry~~ and glass walls. Concrete or masonry walls shall be deemed to satisfy the requirements of Sections 403.2.3.1 and 403.2.3.2. Glass walls complying with the Category II or Class A impact tests specified in Section 2406.2 shall be deemed to satisfy the requirements of Sections 403.2.3.1 and 403.2.3.2.

[BS] 403.2.3.4 Other wall materials. Any other wall materials that provide impact resistance equivalent to that required by Sections 403.2.3.1 and 403.2.3.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

Commenter's Reason: The Glazing Industry Code Committee (GICC) urges you to modify the changes reflected in the Committee's recommendation to adopt G13-19 "as submitted" by **ADDING** the modifications to Section 403.2.3.3 proposed in this Public Comment. Adding these changes to Section 403.2.3.3 will reduce the cost of construction by avoiding the imposition of unnecessary, duplicative and costly testing on the use of glass walls.

Sections 403.2.3.1 and 403.2.3.2 require walls to be Soft or Hard Body Tested to Impact Classification Level 2 as described in ASTM C1629/ASTM C1629M. This is, at most, a 200 ft.lb. impact test that is used to assess the integrity of gypsum wall panels. Because it is only a 200 ft.lb. test, Section 403.2.3.3 provides that both concrete and masonry walls are deemed to comply with Sections 403.2.3.1 and 403.2.3.2.

The modification proposed to Section 403.2.3.3 would add glass walls that meet the 400 ft.lb. safety glazing impact tests of CPSC 16 CFR Part 1201 Cat. II or ANSI Z97.1 Cat. A, to the materials that are deemed to comply with the tests required by Sections 403.2.3.1 and 403.1.3.2. Adding glass walls to Section 403.2.3.3 is fully justified and warranted because safety glazing that meets the requirements of 16 CFR 1201 Cat. II or ANSI Z97.1 Cat. A is already tested to an impact standard that is **twice** as stringent as the Soft or Hard Body Impact tests required by Sections 403.2.3.1 and 403.2.3.2.

GICC urges you to adopt the modifications proposed to Section 403.3.2.3.3 (in addition to the changes reflected in the Committee's recommendation to adopt G13-19 as submitted) to ensure that glass walls are not burdened with the unnecessary and costly testing required for gypsum wall panels by Sections 403.2.3.1 and 403.2.3.2.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

When glass walls are used in applications under these Sections of the Code, adopting the changes proposed to Section 403.2.3.3 will reduce the cost of construction by eliminating the possibility that costly and unnecessary testing would otherwise be required.

Public Comment# 1607

G14-19

IBC®: [BS] 403.2.3.1, [BS] 403.2.3.2, [BS] 403.2.3.4

Proposed Change as Submitted

Proponents: Tim Earl, representing The Gypsum Association (tearl@gbhinternational.com)

THIS CODE CHANGE WILL BE HEARD BY THE IBC-STRUCTURAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE

2018 International Building Code

Revise as follows:

[BS] 403.2.3.1 Wall assembly. The wall assemblies making up the enclosures for *interior exit stairways* and elevator hoistway enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/1629M when tested from the exterior side of the enclosures.

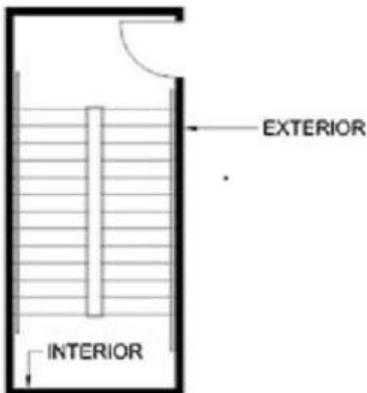
[BS] 403.2.3.2 Wall assembly materials. The exterior face of the wall assemblies making up the enclosures for *interior exit stairways* and elevator hoistway enclosures ~~that are not exposed to the interior of the enclosures for interior exit stairways or elevator hoistway enclosure~~ shall be constructed in accordance with one of the following methods:

1. The wall assembly shall incorporate not fewer than two layers of impact-resistant construction board each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate not fewer than one layer of impact-resistant construction material that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.3.4 Other wall assemblies. Any other wall assembly that provides impact resistance equivalent to that required by Sections 403.2.3.1 for Soft Body Impact Classification Level 3 and 403.2.3.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

Reason: This proposal clarifies which side of these enclosure wall assemblies must be tested for abuse and impact resistance. 403.2.3.2 currently states that the exterior side is tested, but it does so in very confusing language. This proposal cleans that up and reiterates the point in 403.2.3.1. Also note that, due to the manner of construction of these enclosure wall assemblies, testing from the exterior side represents the worst case. This proposal also cleans up 403.2.3.4, which currently implies that 403.2.3.1 and 403.2.3.2 both apply to hard body impact testing, which is not the case. The first section is for soft body impact testing. This is simply a grammatical revision that clarifies the intent of the section.

For clarification, the exterior side is the side which does not face into the enclosure, as the figure below illustrates.



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal simply clarifies the requirements in this section, with no technical changes.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal does not improve the language of the current code.
(Vote: 10-4)

Assembly Action:

None

G14-19

Individual Consideration Agenda

Public Comment 1:

IBC®: [BS] 403.2.3.2, [BS] 403.2.3.4

Proponents:

Tim Earl, representing The Gypsum Association (tearl@gbhinternational.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

[BS] 403.2.3.2 Wall assembly materials. The exterior face of the wall assemblies making up the enclosures for *interior exit stairways* and elevator hoistway enclosures that is not exposed to the interior of the enclosures shall be constructed in accordance with one of the following methods:

1. The wall assembly shall incorporate not fewer than two layers of impact-resistant construction board each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate not fewer than one layer of impact-resistant construction material that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.3.4 Other wall assemblies. Any other wall assembly that provides impact resistance equivalent to that required by Sections 403.2.3.1 for Soft Body Impact Classification Level 2 and 403.2.3.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

Commenter's Reason: The original proposal was intended to clarify the clumsy language of the existing section, which has led to confusion as to which side of these assemblies needs to be tested. The committee felt that the change went too far and actually introduced more confusion. This PC modifies the original proposal language to make it very clear that the side not facing the interior of the stairwell is to be tested. In practice, this is often a corridor, but not always, so the language here is appropriate.

It also corrects an error in the original proposal which inadvertently raised the bar for some assemblies from Soft Body Impact Classification Level 2 to Level 3.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal simply clarifies the requirements in this section, with no technical changes.

Public Comment# 1401

S1-19

IBC: 1511.1 (IEBC 705.1)

Proposed Change as Submitted

Proponents: Wanda Edwards, representing RCI, Inc. (wedwards@rci-online.org)

2018 International Building Code

SECTION 1511 REROOFING

Revise as follows:

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement or roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage and meet the requirements of Section 1608.3.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

2018 International Existing Building Code

Revise as follows:

[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.

Exceptions:

1. *Roof replacement or roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the International Building Code for roofs that provide positive roof drainage and meet the requirements of Section 1608.3 of the International Building Code.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the International Building Code for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502 of the International Building Code.

Reason: The proposed change is a reference to Section 1608.3 – Ponding instability. The added language is a reminder to designers that roofs which do not provide the minimum slope required by the code, are susceptible bays and must be analyzed for ponding instability. By definition a susceptible bay is a roof or portion thereof with a slope less than ¼" inch per foot. Roofs that do not have a minimum slope of ¼" inch per foot must provide positive drainage **and** a ponding analysis. The requirement for the ponding analysis is often overlooked and this change will clarify that the ponding analysis is required.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The code proposal is a clarification and does not alter the requirements of the code. Therefore, the proposal has no cost impact.

S1-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that the proposal was not required, especially as it only effects re-roofing.
(Vote: 12-1)

Individual Consideration Agenda

Public Comment 1:

IBC®: SECTION 1511, 1511.1; IEBC®: [BS] 705.1

Proponents:

Walter Rossiter, representing the International Institute of Building Enclosure Consultants (IIBEC), representing IIBEC (wjrossiter@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

SECTION 1511 REROOFING

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage and meet the requirements of Section 1608.3 and Section 1611.2.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

2018 International Existing Building Code

[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the International Building Code for roofs that provide positive roof drainage and meet the requirements of Section 1608.3 and Section 1611.2 of the International Building Code.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the International Building Code for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502 of the International Building Code.

Commenter's Reason: The purpose of this public comment is to highlight an often-overlooked Code provision that requires susceptible bays to be analyzed for ponding instability. The committee felt that the proposal was not required, especially as it only effects re-roofing. It should be noted that this proposal is especially important for re-roofing projects since they may achieve compliance without the ¼" per foot slope required for new construction. Of special note, re-roofing projects comprise about three quarters of commercial, industrial low-sloped roofing projects performed yearly in the U.S.

This proposed change does not alter the current requirements of the building code. It does, however, clarify a commonly overlooked provision of the Code. 1511.1 and 705.1 Exception 1 allows slopes less than ¼" per foot for re-roofing projects. By definition (2018 IBC Section 202), a roof or portion thereof with a slope less than ¼" per foot is a Susceptible Bay. Chapters 1608.3 and 1611.2 require that susceptible bays be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7. This proposed change adds an additional pointer to another section of the code.

Note: The insertion of Section 1611.2 is to correct an error when the original proposal was prepared. It was inadvertently missing in the published version.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change proposal is a clarification to a current provision and does not alter the requirements of the code. Therefore, the proposal has no cost impact.

Public Comment# 1388

Public Comment 2:

IBC@: SECTION 1511, 1511.1; **IEBC@:** [BS] 705.1

Proponents:

Stewart Verhulst, representing Self (sverhulst@nelsonforensics.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

SECTION 1511 REROOFING

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage and meet the requirements of ~~Section~~ Sections 1608.3 and 1611.2.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

2018 International Existing Building Code

[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the International Building Code for roofs that provide positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2 of the International Building Code.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the International Building Code for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502 of the International Building Code.

Commenter's Reason: In my opinion, the proposed change reflected in S1-19 is a sensible addition to the code, explicitly adding a reference to a relevant code section (1611.2). This will better present a condition that is already required by the code and will provide helpful clarity to building owners and building officials regarding the code requirements for roof drainage. The code already requires that "Susceptible Bays", defined in part as roof bays with slope less than 1/4" per foot, be evaluated for ponding instability.

Roof drainage is a life safety concern, especially considering buildings with Susceptible Bays. I have investigated multiple roof collapses, including a collapse that involved a loss of life, and multiple collapses that escaped likely serious harm or loss of life only because they happened when the building was not fully occupied (at night). This change is sensible and reinforces code requirements that already exist. I view this as a clarification

of code requirements and I believe that the explicit mention of section 1611.2 in this code section will make the built environment safer for the public.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a clarification of existing requirements and does not alter the code requirements or increase cost.

Public Comment# 2066

Public Comment 3:

Proponents:

Stephen Patterson, Roof Technical Services, Inc., representing Roof Technical Services Inc. (spatterson@rooftechusa.com)

requests As Submitted

Commenter's Reason: This is an important life safety issue that is already in the Code, but the reference is relatively obscure. This change reinforces the requirement to verify roofs meet the ponding instability requirements already in the code. Below is my technical support for the proposal.

Public Comment S1-19

My name is Stephen L. Patterson. I am a licensed engineer and registered roof consultant and have extensive experience in roof design and structural issues related to roofs. I have published several papers, a book, and a monograph that address drainage issues. My roofing experience includes being the general manager of a large roofing contracting company and the director of engineering/technical director for 2 roofing manufacturers. I have spent 36 years as a consulting engineer/roof consultant and have designed and inspected literally 1000's of roofs. Roof slope and drainage are among the most important design considerations for roofing and structural analysis.

Section 1611.2 of the 2018 IBC requires "Susceptible bays" of roofs to be "evaluated for ponding instability in accordance with Section 8.4 of ASCE 7." By definition (2018 IBC Section 202), a susceptible bay is a roof or portion thereof with a slope less than 1/4-inch per foot. Therefore, the 2018 IBC currently requires an evaluation for ponding instability for all reroofing projects (roof replacement or roof recover) with slopes less than 1/4-inch per foot. Proposal S1-19 merely reinforces this routinely overlooked provision of the building code.

The requirement for analyzing roof structures for ponding instability has been in the Codes since 1967 (Section 2305(f) 1967 IBC). The design requirement for ponding instability has undergone some changes, but the changes in Section 8.4 of ASCE 7-18 are vastly different and more comprehensive than prior editions.

The requirement for a minimum 1/4:12 (2%) slope was added to the Codes in 1988 (Section 3207.(a) 1988 IBC). Below is an excerpt from "Life Safety Design Issues in Roofing" (Patterson, 2010) illustrating the importance of a minimum 1/4:12 slope. The slope requirements are related to the allowable deflection for roof structures. The 1/4:12 slope requirement provide a positive slope even with the maximum allowable deflection.



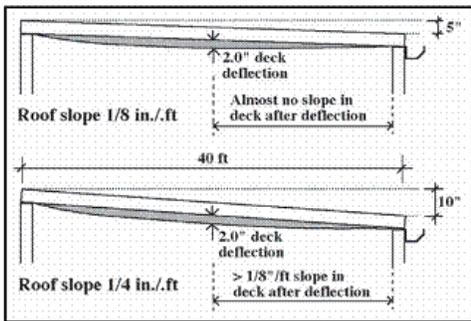
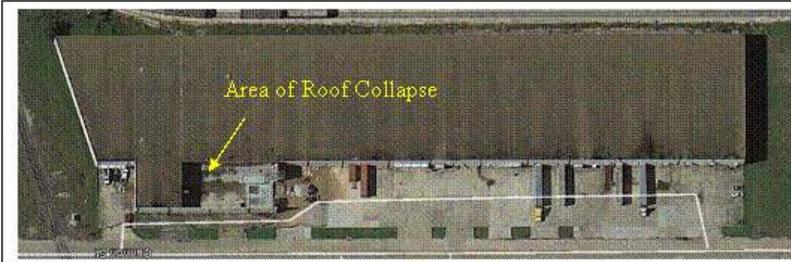


Figure 5 - A roof slope of 1/8 in/ft provides virtually zero net slope after the roof deck assumes its allowable deflection under rain load. A 1/4 in/ft roof slope, on the other hand, leaves a net slope of 1/8 in/ft under the same condition.

Below is an aerial photograph of a roof collapse in Houston, TX in 2013. The basic failure mode of this roof collapse was ponding instability. The roof slope was 1/8:12. There was a hail event with a large amount (several inches) of small hail that caused water to back up on the roof. There was evidence of ponding water along the edge of the roof. However, the water dried up within two days of a rain with good drying conditions, so the roof met the requirements for "Positive Drainage" as defined in the IBC.



Below left is another photograph showing the same collapse shown above. Below right is a photograph (from a different roof) showing how hail blocks the flow of water on a roof and causes water to back up on the roof.



View of roof towards collapsed area

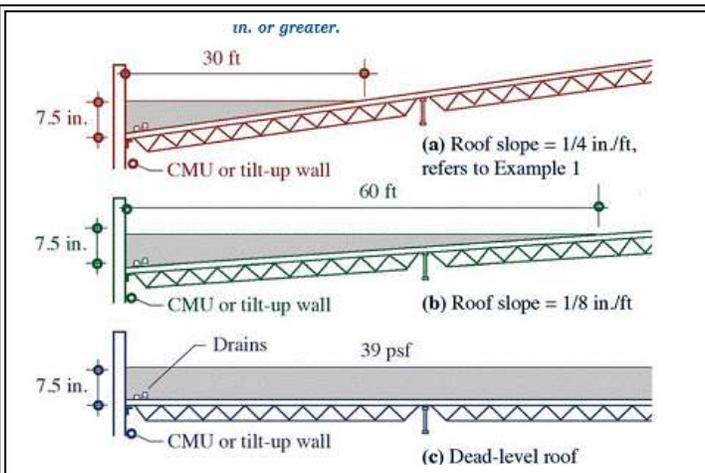


One of the changes in the evaluation of ponding instability addressed in ASCE 7-18 is the structural orientation. The load on the joists is much greater if the joists run parallel to the wall to which the water drains than if the joists are perpendicular to the

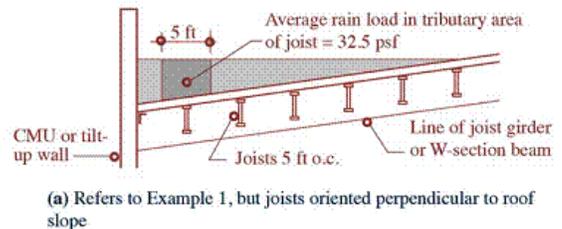
wall. Below is example of a collapse (Dallas), in which ponding instability and structural orientation was an issue. For the record, there were also issues with the size of the secondary drainage system. The buildup of water on the 1st and 2nd joists running parallel to the wall was much greater than if the joists had been perpendicular to the wall, which can result in excessive rainwater load on the joists. The photograph below left shows the roof collapse, and the photograph below right shows the orientation of the joists.



The lower the roof slope, the more water will back up on a roof and the greater the rainwater load on the structure will be. A roof with a slope of 1/8:12 backs up twice as much water as a roof with a slope of 1/4:12. Below is an excerpt from "Roof Drainage Design, Roof Collapses, and the Code" (Patterson and Mehta, 2018) showing the water distribution on a roof with different slopes.

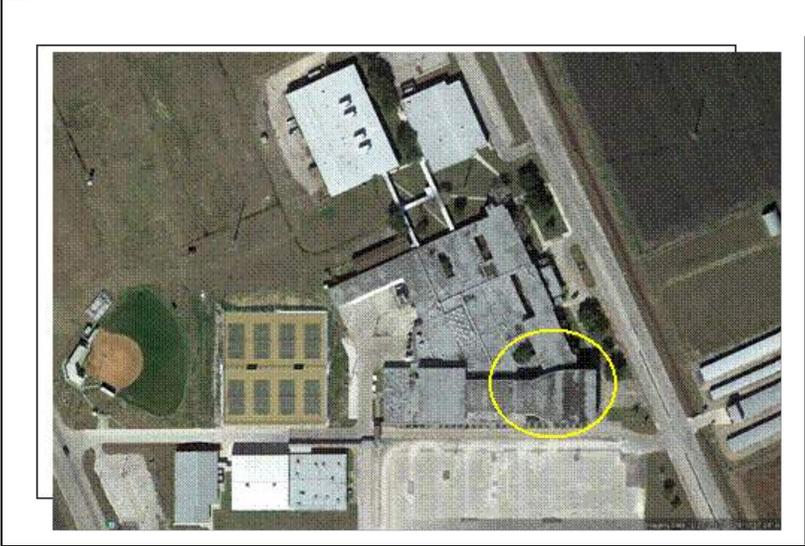


The revised ASCE 7-16 now takes into account the structural orientation. There is much greater load on the joists if the joists are parallel to the low side of the roof than if the joists are perpendicular to the low side of the roof. Below is another illustration from "Roof Drainage Design, Roof Collapses, and the Code" (Patterson and Mehta, 2018) illustrating the ponding instability issue with joists parallel to the low side of the roof.



Suffice to say, ponding instability and the slope of the roof is a very real structural issue. Fortunately, most roofs have 1/4:12 slope and/or are

designed so that the water drains over the edge, and there is no buildup of water. The Codes have required 1/4:12 slope for a very long time, and even before the Code required 1/4:12 slope, industry standards recommended a minimum 1/4:12 slope. However, roofs with less than 1/4:12 slope and ponding water can have very serious structural problems that ultimately can collapse. A good example is the roof of a school that I recently inspected. The building is a relatively large high school, and all of the roof areas with the exception of the auditorium roof had adequate slope and no drainage issues. Below is an aerial showing a dark stain on the auditorium roof circled in yellow.



There are parapet walls around the perimeter of the auditorium roof, and there is no secondary drainage system. The roof was supposed to slope from the center of the roof toward the perimeter of the roof and into through wall drainage scuppers located along the perimeter. After 30 years, there is now a slight negative slope in the roof allowing water to pond. Below are photographs showing the water ponding on the auditorium roof and a photograph of the scupper drains along the edge of the auditorium roof. It rained the morning before I inspected the roof. It is important to understand that this water will dry within 2 days (48 hours) with good drying conditions, so the roof meets the Code requirement for “positive drainage.” However, common sense tells one that there is an issue that needs to be evaluated with this roof.



As I stated earlier, most roofs drain properly and have no issues. However, roofs with drainage problems potentially pose a significant risk and should be evaluated for ponding instability. All contractors, including roofing contractors, should know the provisions of the Code that govern their work. Clearly this roof should be evaluated for ponding instability before reroofing or recovering the roof. It simply is not that expensive or difficult for a contractor to recommend that the owner have a competent structural engineer evaluate the roof ... and it is critical. Furthermore, it is currently required by the code, even though it is oftentimes overlooked.

The proposed modification in S1-19 IBC: 1511.1 reinforces the IBC (Section 1611.2 2018 IBC) requirement to evaluate roofs with slopes less than 1/4:12 for ponding instability when reroofing or recovering a roof. A roof with slopes less than 1/4:12 that has ponding water should not be replaced or recovered without verifying the roof structure is safe and will support the rainwater loads required by Code.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This requirement is already in Code.

Public Comment# 1127

S2-19

IBC: 1511.1 (IEBC 705.1)

Proposed Change as Submitted

Proponents: Wanda Edwards, Wanda Edwards Consulting, Inc., representing RCI, Inc. (wedwards@rci-online.org)

2018 International Building Code

SECTION 1511 REROOFING

Revise as follows:

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement or roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall ~~not be required to~~ meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502.2 ~~for roofs that provide for positive roof drainage~~. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

2018 International Existing Building Code

Revise as follows:

[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.

Exceptions:

1. *Roof replacement or roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the International Building Code for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the International Building Code ~~for roofs that provide for positive roof drainage~~. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502 of the International Building Code.

Reason: In the 2015 the IBC added Exception #2 to Section 1511.1. This exception allows a roof replacement or roof recover to omit secondary drainage if none is present on the existing roof and the roof provides positive drainage. Roofs that provide positive roof drainage do not meet the minimum slope code requirement of 1/4" inch per foot. This exception has created a serious life safety issue because roofs that do not provide adequate slope are prone to collapse when the rainwater accumulation exceeds the design values.¹

There are several reasons for roof collapses. First, many existing buildings were built before the code addressed requirements related to roof slope, roof drains or scuppers. Existing roofs may not have adequate slope or an adequate secondary drainage system and what exists does not meet any code. Most roof collapses are due to inadequate overflow drainage or inadequate slope. Roof drainage design is complicated by the fact that three designers should share in the responsibility for drainage design: the architect, structural engineer and plumbing engineer. Frequently, the structural engineer is not involved in the drainage design nor is a ponding analysis performed.

Remember, code requirements are minimum allowable standards and do not address some of the critical issues of drainage design. For instance, the code does not address flow rates through drains as a function of hydraulic head. The information contained in the IPC is the maximum drainage capacity of the roof drains with no reference to hydraulic head. Because the roof drainage is so important to performance of the roof a reroof should automatically trigger an analysis of the existing drainage system

In a white paper presented at the 2018 RCI Annual Convention, Dr. Steve Patterson, PE and Dr. Medan Mehta, PE details the problems of not installing secondary roof drainage and the failures that they have investigated. The paper gives an in-depth analysis of roof drainage design and how water accumulates on the roof and results in collapse. The paper also reviews the code history of drainage design and requirements. Their research confirmed that secondary drainage has been a code requirement since the 80's. Exception #2 of Section 1511.1 represents the deletion of a long-standing code requirement.

Ponding instability is defined as the progressive increase in the accumulation of water on the roof due to insufficient stiffness of the roof framing. As the water accumulates on the roof, the roof deflects, and the deflection continues to increase with the accumulation of more water due to the increased roof deflection. The requirement to check for ponding instability has been in the code for at least 14 years. The code does not require a ponding analysis unless the slope is less than 1/4" inch per foot one. The requirement of a ponding analyses often are overlooked and these analyses are not being performed.

"Allowing roof slopes less than 1/4" inch per foot creates many problems. Water should drain freely and quickly – let alone be allowed to remain on the roof for two days. No one tests the roof to see if there is ponding – they don't flood the roof and wait two days to see if there is any ponding on the roof. The roof could have no slope and be code compliant. If there are parapet walls and no overflow drainage, the roof is highly susceptible to ponding."²

Roof drainage is one of the most important roof design elements and the overflow drainage is its most part – the function of the overflow drainage is to prevent the roof from collapsing – an important life safety issue. For these reasons, secondary drainage should once again be required in the code. "Fundamentally, any roof that has drainage issues – including but not limited to the lack of appropriate slope or the lack of adequate overflow- should be evaluated by when a building is reroofed in the same as required for roofing."³

Bibliography: 1. Wanda Edwards. Secondary Drainage and Ponding Requirements of IBC and IEBC. Interface, December 2017 issue.
2. Stever Patterson and Medan Mehta. Roof Drainage, Roof Collapses and the Codes. March 2018, 32nd Annual RCI Convention proceedings, page 122

3. Ibid.

Cost Impact: The code change proposal will increase the cost of construction
The code change will increase the cost of construction when compared to the 2018 IBC. It will not represent a cost increase when compared to the 2012 IBC.

S2-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt this code change proposal was unnecessary - existing code is acceptable.
(Vote: 12-1)

Assembly Action:

None

S2-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1511.1; **IEBC@:** [BS] 705.1

Proponents:

Walter Rossiter, representing the International Institute of Building Enclosure Consultants (IIBEC), representing IIBEC (wjrossiter@verizon.net)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall ~~not be required to~~ not require modification to the primary drainage system to meet the requirement for of Section 1502.1, provided secondary (emergency overflow) drains or scuppers ~~in complying with~~ Section 1502.2 ~~1503.4 for roofs that provide for positive roof drainage are present or installed.~~ For the purposes of this exception, existing primary or secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by primary or secondary drains or scuppers designed and installed in accordance with Section ~~1503.4~~ 1502.

2018 International Existing Building Code

[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the International Building Code for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall ~~not be required to~~ not require modification to the primary drainage system to meet the requirement for of Section 1502.1, provided secondary (emergency overflow) drains or scuppers ~~in complying with~~ Section 1502.2 ~~1502~~ of the International Building Code ~~for roofs that provide for positive roof drainage are present or installed.~~ For the purposes of this exception, existing primary or secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by primary or secondary drains or scuppers designed and installed in accordance with Section 1502 of the International Building Code.

Commenter's Reason: Prior to the 2015 IBC, emergency overflow drainage was required for all roofing projects to prevent structural failure in the event the primary drainage system became blocked for any reason. In the 2015 Code Development Cycle, Exception 2 was added to remove this requirement, thereby not allowing discharge to occur before overloading the structure. This modification returns the Code to comply with the requirements in force prior to the 2015 modification.

This modification also corrects an incorrect reference to Section 1503.4 that addresses attic ventilation and should not be part of IBC Section 1511.1.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This code change proposal will not represent a cost increase when compared to the 2012 IBC.

Public Comment# 1389

Public Comment 2:

Proponents:

Stephen Patterson, Roof Technical Services Inc., representing Roof Technical Services, Inc. (spatterson@rooftechusa.com)

requests As Submitted

Commenter's Reason: This is an important life safety code modification that restores the decades old requirement to provided overflow drainage on buildings that require overflow drains or scuppers but do not have them. Below is my technical support for this proposal.

Public Comment S2-19

My name is Stephen L. Patterson. I am a licensed engineer and registered roof consultant and have extensive experience in roof design and structural issues related to roofs. I have published several papers, a book, and a monograph that address drainage issues. My roofing experience includes being the general manager of a large roofing contracting company and the director of engineering/technical director for two roofing manufacturers. I have spent 36 years as a consulting engineer/roof consultant and have designed and inspected literally 1000's of roofs.

This proposed change to the code modifies Exemption 2 in Section 1511.1 in the 2018 IBC to reinstate the decade's old requirement to ensure that there is an overflow drainage system in accordance with the provisions of Section 1502.2 when recovering or reroofing a building. Exemption 2 was added in 2015, and Exemption 2 eliminates the requirement "to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 (section number was changed to 1502.2 in 2018)...." This modification leaves in place the exemption deleting the requirement that

the primary drainage system meet the current plumbing code requirement when recovering or reroofing a building.

The primary drainage system is not a critical drainage element from a structural design perspective. Based on Section 1611 Rain Loads, the assumption is the primary drainage system is blocked, and the structural engineer calculates the depth of water that accumulates over the overflow (secondary) drainage system to determine that the structure is adequate to support the rainwater loads. In other words, the primary drainage system is taken out of the equation for calculating rainwater loads on a building. It is the secondary or overflow drainage system that is the critical element, and it is imperative that there is an overflow drainage system to prevent roofs from collapsing. The following is a more detail discussion of the technical reasons in support of this modification.

I have investigated well over 50 roof collapses in my career. A majority of these collapses involve the lack of an appropriate overflow drainage system. Fundamentally, overflow drainage systems are designed to prevent an unsafe build-up of water on a roof in the event the primary drainage system is blocked, restricted, or overwhelmed. Below are the key issues that will be discussed in this commentary.

First of all, this modification in the Code only affects a very small percentage of roofs that are reroofed every year. The vast majority of roofs either drain over the edge and do not require an overflow drainage system or already have an overflow drainage system. These roofs are not affected by this modification.

This discussion concerns roofs with parapet walls where water can build up on a roof if the primary drains become blocked or overwhelmed. These roofs absolutely require overflow drains. The lack of overflow is mistake; it a design and/or construction defect. An overflow drainage system is a fundamental structural design requirement for a roof structure and the roof.

In the vast majority of cases, overflow drains or scuppers can easily be added, and the cost is relatively low. The requirement to ensure there is an overflow drainage system when recovering or reroofing a building has been in the Codes for decades. For the most part, the roofing community has dealt with this issue successfully with few, if any, problems.

The only problems I am aware of are contractor liability issues. Specifically, I am talking about roofs where the roofing contractor failed to add overflow when they reroofed the building and the roof collapsed. To be sure, these are relatively rare occurrences, but the consequences are significant, and the costs associated with roof collapses are in the millions.

I sincerely believe that the underlying reason for the National Roofing Contractors Association's (NRCA's) 2015 proposed modification to eliminate the requirement for overflow drainage was an attempt to protect roofing contractors from litigation arising out of the failure of roofing contractors to meet the Code and had little to do with the cost or complexity of adding overflow drains.

The following commentary addresses the issues described above more fully.

The secondary drainage system is a fundamental element in the calculus for designing roof structures. IBC: Section 1611 Rain Loads states, **“Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow.”** Without a secondary drainage system, the roof must be able to support the weight of water that would accumulate to the height of the parapet wall, and there are very few buildings that will meet this criterion. Below is an excerpt from the 2018 IBC, showing the design rain load requirement.

SECTION 1611 RAIN LOADS

1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow. The design rainfall shall be based on the 100-year hourly rainfall rate indicated in Figure 1611.1 or on other rainfall rates determined from *approved* local weather data.

The vast majorities of roofs either drain over the edge and do not require overflow or already have overflow drainage systems. This proposed code change only affects a small percentage of buildings, e.g. roofs surrounded by parapet walls that have no overflow drainage system. Any roof with parapet walls and without an overflow drainage system is a design and/or construction defect, with very few exceptions. The requirement to provide overflow drainage systems was included in the 1st Uniform Building Code published in 1927. Below is an excerpt from Section 3206 of the 1927 Uniform Building Code stating that, **“Overflows shall be installed at each low point of the roof to which the water drains.”**

**Roof
Drainage**

Sec. 3206. Roofs of all buildings shall be sloped so that they will drain to gutters and downspouts which shall be connected with conductors to carry the water down from the roof underneath the sidewalk to and through the curb. Overflows shall be installed at each low point of the roof to which the water drains.

These requirements were essentially unchanged in the UBC until 1967, when UBC refined the requirement for overflow. Below is an excerpt from the 1967 UBC, which provided more definitive requirements for overflow.

Roof Drainage

Sec. 3206. Roof drainage water from a building shall not be permitted to flow over the public sidewalk. Buildings of Group I or J Occupancies may be exempted from this provision.

Roof drains shall be installed when required at each low point of the roof to which the water drains, and shall be adequate in size to drain the roof.

Overflow drains shall be installed when required with the inlet flow line located two inches (2") above the low point of the roof, or overflow scuppers may be installed in parapet walls at each low point of the roof with the flow line not more than two inches (2") above the adjacent roof.

Concealed roof drainage pipe shall be installed as required for soil, waste, or vent piping.

Suffice to say, the requirement to provide overflow on Buildings has been a code requirement for a very long time. In my career of almost 50 years, I have encountered maybe 4 or 5 roofs where the roof structure would support the weight of water to the top of the parapet walls. In all cases, these roofs had cast-in-place concrete decks that had been designed as future floors.

An overflow drainage system is not only a Code requirement but is common sense. Drains will become blocked at some point during the life of a building, whether from the lack of maintenance, a natural phenomenon like hail, blowing debris during hurricanes or thunderstorms, or from debris left on a roof. There is a very real possibility of a roof collapse if there is no safety valve (overflow drainage system) to prevent an unsafe build-up of water. That is why overflow drainage has been a part of the Codes since the modern codes were introduced.

One of the first collapses I investigated in Fort Worth was a grocery store that had one scupper drain and no overflow. Someone threw a Sunday Fort Worth Star Telegram newspaper onto the roof, which became lodged in and completely blocked the scupper drain. Debris tends to migrate to the low point in the roof (the drain) with the flow of rainwater on the roof. Below are photographs of a drain blocked by airborne plastic shopping bags that resulted in the collapse of a Home Depot Store.



Another issue is rainfall intensity. Climate change is impacting rainfall rates, as warm air holds more moisture than cold air. A secondary purpose for an overflow drainage system is to provide additional drainage capacity in the event the rainfall rate exceeds the design rainfall rate. Intense

weather events like hurricanes, tropical storms, and severe thunderstorms create the conditions that can result in a roof collapse when the roof does not have an overflow system. Hurricane Harvey was a good example. The rainfall rates that occurred during Hurricane/Tropical Storm Harvey significantly exceeded the 1-hour, 100-year rainfall rate, which is the current design standard for roof drains. As a result, there were numerous collapses in the Gulf Coast of Texas from Harvey. Below is a headline in the Los Angeles Times.



In 1979, the Uniform Building Code added Chapter 32 in the Appendix of the code, which included reroofing requirements. Section 3209 (Chapter 32 in the Appendix) required that, "All re-roofing shall conform to the applicable provisions of Chapter 32 of this Code," which included the requirement for overflow drainage. This requirement for ensuring there was adequate overflow drains when reroofing a building was also incorporated into the first and subsequent IBC editions until 2015. This requirement was in the Codes for 36 years with no issues other than contractor liability issues. Overflow has been a fundamental life safety design issue for decades. The lack of a secondary drainage system is a serious design defect that is relatively easy to correct. This requirement for secondary drainage as well the requirement to meet all the other drainage requirements was deleted from the 2015 IBC.

Today, a roofing contractor can reroof a building and modify the existing drainage system without any code-required limitations. The Codes typically require contractors to use a licensed plumber to modify the plumbing on a simple remodel. Yet a roofing contractor can simply change the drainage design with no restrictions. Below are photographs of a roof collapse on a large manufacturing building in Dallas, Texas and a school in Little Rock, Arkansas. Both roofs collapsed after roofing contractors modified the drainage system and failed to provide a secondary drainage system. Both reroof installations would meet the current code requirements.



Roof collapses are a serious life safety issue. Fortunately, I have only worked on one roof collapse where there were fatalities. There have been many close calls. Maintenance personnel at the Little Rock school shown above heard noises and were able to evacuate the teachers before the roof collapsed. The Home Depot roof collapsed along the checkout isle an hour before the store opened. On May 5, 1995, we had a major hailstorm in the DFW area. A large number of people were caught out in the open at Mayfest, an outdoor festival. There were serious injuries as a

result of the hailstorm but no deaths. There were, however, two fatalities from a roof collapse at the Haggar Apparel Manufacturing Plant that occurred during the 1995 hailstorm. As stated previously, hail has a tendency to block drains and can cause a roof collapse if there is no overflow system. Below are excerpts from the Dallas Morning News describing the events from the 1995 storm.

This story was originally published on May 6, 1995:

Torrential rains, winds up to 70 mph and hail as big as grapefruits blasted North Texas on Friday night, causing at least four deaths, hundreds of injuries and widespread property destruction.

Hail and rain began falling about 6 p.m., blanketing streets and flooding areas from Weatherford to Dallas. Air, street and electronic traffic was snarled, disrupting 911 service in some areas and stranding motorists and airline passengers.

Two people were confirmed dead and 12 injured after the roof reportedly collapsed at the Haggar Apparel Manufacturing office on Lemmon Avenue in Dallas, officials said.

"All of a sudden you heard a boom, and people started screaming. 'Let me out, let me out!'" said Haggar employee Angel Solis.

The costs associated with adding overflow are relatively small. A normal overflow scupper costs around \$500 to \$1,000. A normal overflow drain costs around \$1,500 to \$3,000. Below are photographs from a roof collapse in Dallas, Texas. This is a good example that helps put the costs into perspective. The cost of the loss was in the millions of dollars due to the damage to the structure, loss of inventory, and business interruption. The roof was approximately 140,000 SF, and the cost to provide a secondary drainage system was approximately \$14,000. The cost to replace the roof was approximately \$1,120,000.00. The cost to increase the insulation to meet the Energy Code was approximately \$210,000, more than 10 times the cost of the overflow system.





Below is an excerpt from the 2018 IPC showing the Secondary (**Emergency**) Roofs Drains Section 1108. Overflow drains provide emergency relief in the event the primary drains are blocked or overwhelmed during intense rain events. This requirement combined with Section 1611 in the 2018 IBC defines the issue with overflow.

**SECTION 1108
SECONDARY (EMERGENCY) ROOF DRAINS**

1108.1 Secondary (emergency overflow) drains or scuppers.

Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. Where primary and secondary roof drains are manufactured as a single assembly, the inlet and outlet for each drain shall be independent.

1108.2 Separate systems required.

Secondary roof drain systems shall have the end point of discharge separate from the primary system. Discharge shall be above grade, in a location that would normally be observed by the building occupants or maintenance personnel.

Roofs where “water will be trapped if the primary drains allow a buildup for any reason,” absolutely require an overflow drainage system, whether it is a new roof or a reroof. To summarize ...

Roofs without an overflow drainage system where water will be entrapped is a design and/or construction defect ... a defect that needs to be corrected.

The structural design of the building relies upon the overflow system in designing the roof structure for rain loads.

The lack of an overflow drainage system is the most common cause of roof collapses, which can be catastrophic events costing millions and resulting in the loss of life.

The modification proposed by RCI/IIBEC simply reinstates this critical life safety code requirement, a requirement that has been in the Codes for decades.

We are only talking about a small percentage of buildings where there is a need to correct a design and/or construction defect that will prevent roofs from collapsing.

Meeting this code requirement was not a problem in the decades that it was in the Codes.

Thank you for your consideration.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This proposed change restores a decades old code requirement for overflow and will not increase the costs based on editions of the IBC prior to 2015.

It will involve a relatively modest cost increase over the current code, which is discussed in my technical support in "Reasons."

Public Comment# 1528

Public Comment 3:

Proponents:

Stewart Verhulst, representing Self (sverhulst@nelsonforensics.com)

requests As Submitted

Commenter's Reason: In my opinion, the proposed change reflected in S2-19 is an important change that will allow for safer buildings. I have investigated many roof collapses that were caused by inadequate drainage. In many cases, properly designed and installed secondary drainage would have prevented the collapse.

Roof drainage is a life safety concern. I recently investigated a structure that experienced a roof collapse over an office area due to one blocked primary drain and a lack of secondary drainage. The roof had been re-roofed years earlier and no secondary drainage was added. Luckily, the collapse happened in the night and nobody was injured or killed. I have investigated other roof collapses that happened because of a lack of proper secondary drainage and I have identified safety concerns on other buildings due to poor roof drainage. This includes a high school where the secondary drains were up to 9" above the level of the primary drains. It is in the best interest of building occupants and the safety of the public for roofs to have proper roof drainage.

The modification of this code section will make the built environment safer for the public.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This change will increase the initial cost of construction. However, some costs will decrease over the long term due to better roof performance and less roof collapses. Also, this change will increase public safety.

Public Comment# 2080

S3-19

IBC: 1511.6.1 (New)

Proposed Change as Submitted

Proponents: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

2018 International Building Code

1511.6 Flashings. Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

Add new text as follows:

1511.6.1 Flashing Heights. Wall and curb flashings shall be not less than 8 inches (203 mm) above the roof covering surface. A reduction of the required roof assembly thickness to accommodate the limited heights shall be in accordance with the roof covering manufacturer's instructions.

Reason: The purpose of this code proposal is to provide the code official guidance when roofing work takes place on existing buildings. When the scope of work is to replace the roof covering, (See 202 definition for roof covering replacement), the building owner and manager should not have to rebuild the rooftop to accommodate thick roofing components.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This code proposal will provide the building owner and manager with the option to not have to rebuild the roof assembly in some cases. In other cases, it does not provide cost savings.

S3-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The code change proposal's intent is unclear and may create other issues with re-roofing.

(Vote: 14-0)

Assembly Action:

None

S3-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1511.6.1 (New)

Proponents:

Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1511.6.1 Flashing Heights. ~~For roofs with slope <2:12, w~~ wall and curb flashings shall be not less than 8 inches (203 mm) above the roof covering surface. A reduction of the required roof assembly thickness to accommodate the limited flashing heights shall be allowed. ~~in accordance with the roof covering manufacturer's instructions.~~

Commenter's Reason: During the Committee Action Hearings, there were comments that skylights are allowed to be 4" above the roof surface.

The intent of the proposal was to mandate 8" flashing heights for low sloped roofs - those roofs 2:12 - and not medium or steep slope roofs. Therefore, the proposal has been modified to state the scope of the passage is for low slope roofs. The second adjustment is to address the committee statement that the proposal is unclear. The changes make the proposal focused at what was originally intended and clarifies the proposal.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The exact amount of decrease is difficult to determine. However, by limiting the thickness of the roof assembly, curbs do not have to get replaced, nor walls with doors or windows too low have to be replaced.

Public Comment# 1792

Public Comment 2:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it adds unnecessary and confusing language regarding roofing wall and curb flashing heights. Flashing height requirements are appropriately addressed in manufacturer's installation instructions and existing IBC requirements.

- First, the proposal's prescriptive requirement for 8" flashing heights is improper. The prescriptive limit will restrict well-accepted roofing industry installation practices and create potential conflicts with manufacturer's installation instructions.
- Second, the proposal improperly references "required roof assembly thickness." The building code does not regulate roof assemblies by thickness. Therefore, the proposed language is unenforceable and confusing.
- Third, the proposal will create problems for existing buildings. Many existing roofs are constructed with flashing heights less than 8 inches. In a roof recover project, materials in the existing assembly may need to be removed in order to comply with the proposed minimum flashing height requirement. This could result in reduced energy efficiency in existing roof systems, and it is counter-intuitive to the intent of the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1638

S4-19

IBC: 1511.5 (New)

Proposed Change as Submitted

Proponents: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (Bill@mc-hugh.us)

2018 International Building Code

Add new text as follows:

1511.5 Roof Covering Replacement. Where an existing roof covering is removed, exposing insulation or sheathing and only a new roof covering is installed.

Reason: The purpose of this proposal is to put code language that ties in with the new definition in section 202 for Roof Covering Replacement. This provides guidance to code users for an area that is not covered at all by the code. This situation, roof covering replacement, is a question that's asked about frequently. This is where the roof covering system life can be extended by adding a new roof covering material alone by 'peeling' off the old roof covering material. There are situations where this method is not only practical but preferred. In fact, the City of Chicago added this definition through it's 2016 Roofing Memorandum.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code proposal provides an option not available to the building owner and manager. The result is it will be no increase in the cost of construction where or a big savings in cost due to not having to rework the roof assembly to accommodate roofing component thicknesses.

S4-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The code change is not required. The proposal creates a definition for which there are no current code requirements and is not utilized elsewhere.

(Vote: 14-0)

Assembly Action:

None

S4-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1511.5 (New)

Proponents:

Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1511.5 Roof Covering-Membrane Peel and Replacement. For roofs <2:12, where an existing roof covering-membrane is removed, exposing insulation or sheathing and only a new roof membrane covering is installed, the thickness of the roof assembly shall be allowed to be reduced to the maximum amount that will accommodate existing flashing heights.

Commenter's Reason: The reason for this public comment is to address the committees concerns that the language was incomplete. Secondly, there is new information since the Committee Action Hearings.

This new language is now part of the Chicago adoption of the International Family of Codes and the Illinois Adoption of the 2018 International Energy

Conservation Code.

Roof membrane peel and replacement is a way to provide longer service life to the insulation installed on the building's rooftop. Through re-use of the insulation, life cycle costs of the insulation are reduced. If the membrane peel causes surface irregularities, the roof membrane manufacturer can recommend adequate measures such as a suitable cover board to prepare the surface.

There are over 900,000 listings in the FM Approval Guide alone, not counting UL's listings. That gives the designer the ability to find another listing, using the insulation, cover board, and new membrane and matching it to a listing, providing code compliance.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The effect of this code change is that the building owner and manager does not need to buy new insulation for this type or roof operation. The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings. The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasibility on an existing building.

Public Comment# 1795

Public Comment 2:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates life-safety issues for reroofing.

- This proposal introduces new category of reroofing that is not necessary because Chapter 15 of the IBC (Section 1511.3 "Roof Replacements") already offers two options for reroofing: roof replacement and roof recover. Section C1511.3.1 "Roof Recover" permits a one-time roof recover without the removal of the membrane to extend the life of the roof system.
- This proposal is in direct conflict with Section 1511.3 "Roof Replacement" provisions of the IBC, which requires removal of all materials down to the roof deck. In addition, this proposal offers other challenges and concerns. It allows for the replacement of the roof membrane alone without removal of materials below the membrane and thus does not provide an opportunity for assessing the condition of the roof deck. Roof decks are structural components of the roof system that transfer loads to the supporting structure and conditions assessment is a critical part of good reroofing practice. Recommendation for existing roof decks to be inspected from both above and below is part of the long-standing guidance from the National Roofing Contractors Association.
- In addition, this proposal will create a loophole allowing for substitution of roof covering materials that are not in compliance with recognized third-party system listings (such as FM Global or UL) with regard to wind uplift and fire resistance performance. Third-party test agencies issue roof system listings for roof recover and roof replacement systems, but not for a "peel and replaced" roof membrane project.

Bibliography: Chapter 9 Reroofing, "The NRCA Roofing Manual: Membrane Roof Systems," National Roofing Contractors Association (2019).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1640

S5-19

IBC: 1511.3 (IEBC 705.3)

Proposed Change as Submitted

Proponents: Mike Fischer, Kellen Company, representing The Polyisocyanurate Insulation Manufacturers Association (mfischer@kellencompany.com); Marcin Pazera, representing The Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

2018 International Building Code

Revise as follows:

1511.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings and roof assembly materials down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

Reason: The current code language instructs the user to remove all roofing materials down to the deck when performing a roof replacement. The exception for ice barrier membrane illustrates that fact. The definition of roof replacement includes instructions to repair damaged substrate (such as the roof deck and supporting structure):

ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*.

IBC Section 1511.1 reads:

Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Requirements for roof assemblies in Chapter 15 include assembly testing for wind and fire resistance. The assembly tests typically include all materials including fasteners, insulation, and cover boards. There have been indications of a practice known as "peel and replace" where only the outermost layer (roof covering membrane) is removed, and another membrane subsequently applied. This practice makes it impossible to meet the IBC provisions for repairing damaged substrate because the deck will not be exposed for inspection. It also conflicts with 1511.3 because the requirements for wind and fire testing are based on assembly tests with known materials, not an assembly of new and existing materials that may or may not comply with current material properties and standards.

This proposal is a clarification of the current code provisions, industry recommendations, and test requirements. The need to install new roof assembly materials in a roof replacement in a manner that is consistent with tested assemblies is necessary to demonstrate code compliance and ensure that the system will perform as intended. This interpretation of the intent of the code is consistent with industry guidance on the subject.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is a clarification to current requirements.

S5-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification: 2018 International Building Code

1511.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of ~~roof coverings and~~ roof assembly materials down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

Committee Reason: The provision is a clarification of existing code. Clarifies what is removed in a 'roof replacement'. The modification removes

redundant language. (Vote: 14-0)

Assembly Action:

None

S5-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests Disapprove

Commenter's Reason: It is unclear that in this committee approved proposal that the roof deck now has to be removed and replaced during roof replacement. In addition, this now means tons of materials that could be reused go into landfills. Why should material - insulation, ballast - other items - that have more usable life be put in landfills? The mandate to remove all materials, is in conflict with S10-19, the NRCA's approved proposal in section 1511.5, Reinstallation of materials - that allows reuse of gravel and ballast. This proposal has made compliance difficult, at best.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The effect of disapproval means that some materials do not have to be removed and replaced. This code proposal, if passed, will increase the cost of construction.

Public Comment# 1799

S9-19

IBC: 1511.1 (IEBC 705.1)

Proposed Change as Submitted

Proponents: Wanda Edwards, Wanda Edwards Consulting, Inc., representing RCI, Inc. (wedwards@rci-online.org)

2018 International Building Code

SECTION 1511 REROOFING

Revise as follows:

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

~~Exceptions~~**Exception:**

- ~~1. Roof replacement or roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.~~
- ~~2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.~~

Reason: In 2015 the IBC added Exception #2 to Section 1511.1. This exception allows a roof replacement or roof recover to omit secondary drainage if none is present on the existing roof and the roof provides positive drainage. Roofs that provide positive roof drainage do not meet the minimum slope code requirement of 1/4" inch per foot. This exception has created a serious life safety issue because roofs that do not provide adequate slope are prone to collapse when the rainwater accumulation exceeds the design values.

There are several reasons for roof collapses. First, many existing buildings were built before the code addressed requirements related to roof slope, roof drains or scuppers. Existing roofs may not have adequate slope or an adequate secondary drainage system and what exists does not meet any code. Most roof collapses are due to inadequate overflow drainage or inadequate slope. Frequently, the structural engineer is not involved in the drainage design nor is a ponding analysis performed, and this exception does not require the installation of secondary drainage.

In a white paper presented at the 2018 RCI Annual Convention, Dr. Steve Patterson, PE and Dr. Medan Mehta, PE details the problems of not installing secondary roof drainage and the failures that they have investigated. The paper gives an in-depth analysis of roof drainage design and how water accumulates on the roof and results in collapse. The paper also reviews the code history of drainage design and requirements. Their research confirmed that secondary drainage has been a code requirement since the 80's. Exception #2 of Section 1511.1 represents the deletion of a long-standing code requirement. Roof drainage is one of the most important roof design elements and the overflow drainage is its most part – the function of the overflow drainage is to prevent the roof from collapsing – an important life safety issue. For these reasons, secondary drainage should once again be required in the code.

Bibliography: Steve Patterson and Medan Mehta. Roof Drainage Design, Roof Collapses and the Codes. March 2018, 32nd Annual RCI Convention proceedings, page 122.

Cost Impact: The code change proposal will increase the cost of construction

When compared to the 2018 IBC, the proposal will increase the cost of construction. However, comparing the proposal to the 2012 IBC, there will be no increase in cost.

S9-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Current code exception was a reasonable compromise in the previous edition of the Code. No need for change at this time. (Vote: 12-1)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Patterson, representing Roof Technical Services, Inc. (spatterson@rooftechusa.com)

requests As Submitted

Commenter's Reason: This proposed modification restores the decades old requirement to ensure that there is an overflow drainage system on buildings without an overflow drainage system that need an overflow drainage issues. It is an important life safety issue. Below is my technical support for this proposal.

Public Comment S9-19

My name is Stephen L. Patterson. I am a licensed engineer and registered roof consultant and have extensive experience in roof design and structural issues related to roofs. I have published several papers, a book, and a monograph that address drainage issues. My roofing experience includes being the general manager of a large roofing contracting company and the director of engineering/technical director for two roofing manufacturers. I have spent 36 years as a consulting engineer/roof consultant and have designed and inspected literally 1000's of roofs. I have investigated well over 50 roof collapses in my career.

This proposed change in the code eliminates Exemption 2 in Section 1511.1 in the 2018 IBC. Exemption 2 was added in 2015, and Exemption 2 eliminates the requirement "to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4...." It is my opinion that Exemption 2 should be removed in order to restore the requirement to meet the requirement for emergency overflow drains or scupper whenever a building is reroofed or the roof is recovered. My Public Comments on S-2 and S-8 provide a detailed discussion explaining the need for emergency overflow drains or scuppers. Please review my Public Comments on S-2 and S-8. The following simply highlights many of the point included in my Public Comments on S-2 and S-8.

Fundamentally, overflow drainage systems are designed to prevent an unsafe build-up of water on a roof in the event the primary drainage system is blocked, restricted, or overwhelmed. A majority of these collapses involve the lack of an appropriate overflow drainage system. Below are the key issues.

First of all, this modification in the Code only affects a very small percentage of roofs that are reroofed every year. The vast majority of roofs either drain over the edge and do not require an overflow drainage system or already have an overflow drainage system. These roofs are not affected by this modification.

This discussion concerns roofs with parapet walls where water can build up on a roof if the primary drains become blocked or overwhelmed. These roofs absolutely require overflow drains. The lack of overflow is mistake; it a design and/or construction defect. An overflow drainage system is a fundamental structural design requirement for a roof structure and the roof.

In the vast majority of cases, overflow drains or scuppers can easily be added, and the cost is relatively low. The requirement to ensure there is an overflow drainage system when recovering or reroofing a building has been in the Codes for decades. For the most part, the roofing community has dealt with this issue successfully with few, if any, problems.

The only problems I am aware of are contractor liability issues. Specifically, I am talking about roofs where the roofing contractor failed to add overflow when they reroofed the building and the roof collapsed. To be sure, these are relatively rare occurrences, but the consequences are significant, and the costs associated with roof collapses are in the millions.

I sincerely believe that the underlying reason for the National Roofing Contractors Association's (NRCA's) 2015 proposed modification to eliminate the requirement for overflow drainage was an attempt to protect roofing contractors from litigation arising out of the failure of roofing contractors to meet the Code and had little to do with the cost or complexity of adding overflow drains.

Based on the 2015 change and this current 2018 IBC, a roofing contractor can reroof a building and modify the existing drainage system without any code required limitations. The Codes typically require contractors to use a licensed plumber to modify the plumbing on a simple remodel. Yet a roofing contractor can simply change the drainage design with no restrictions. Below are photographs of a roof collapse on a large manufacturing building in Dallas, Texas and a school in Little Rock, Arkansas. Both roofs collapsed after roofing contractors modified the drainage system and failed to provide a secondary drainage system. Both reroof installations would meet the current code requirements.



Roofs where “water will be trapped if the primary drains allow a buildup for any reason,” absolutely require an overflow drainage system, whether it is a new roof or a reroof. To summarize ...

Roofs without an overflow drainage system where water will be entrapped is a design and/or construction defect ... a defect that needs to be corrected.

The structural design of the building relies upon the overflow system in designing the roof structure for rain loads.

The lack of an overflow drainage system is the most common cause of roof collapses, which can be catastrophic events costing millions and resulting in the loss of life.

The modification proposed by RCI/IIBEC simply reinstates this critical life safety code requirement, a requirement that has been in the Codes for decades.

We are only talking about a small percentage of buildings where there is a need to correct a design and/or construction defect that will prevent roofs from collapsing.

Meeting this code requirement was not a problem in the decades that it was in the Codes.

Thank you for your consideration.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This change will increase the construction cost on the small percentage of roofs that require overflow. The costs represent a fraction of the reroofing costs.

This change will restore the decades old requirement and would not represent a cost increase based on the IBC editions prior to 2015.

Public Comment# 1534

Public Comment 2:

Proponents:

Walter Rossiter, representing the International Institute of Building Enclosure Consultants (IIBEC), representing IIBEC

requests As Submitted

Commenter's Reason: Prior to the 2015 IBC, emergency overflow drainage was required for all roofing projects to prevent structural failure in the event the primary drainage system become blocked for any reason. In the 2015 Code Development Cycle, Exception 2 was added to remove this requirement, thereby not allowing discharge to occur before overloading the structure. This modification returns the Code to comply with the requirements in force prior to the 2015 modification.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This code change proposal will not represent a cost increase when compared to the 2012 IBC.

Public Comment# 1257

S17-19

IBC: 1504.5.1 (New), SPRI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Amanda Hickman, representing The Single-Ply Roofing Industry (SPRI) (amanda@thehickmangroup.com)

2018 International Building Code

Add new text as follows:

1504.5.1 Gutter securement for low-slope roofs. External gutters that are used to secure the edge of the roof membrane on low-slope (less than 2:12 slope) built-up, modified bitumen, and single ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

SPRI

Single-Ply Roofing Institute
465 Waverly Oaks Road, Suite 421
Waltham MA 02452

GT-1-2016: Test Standard for Gutter Systems

Reason: KULIK: Studies of the aftermath of high-wind events revealed that many gutter systems did not resist the loads that occur during these high-wind events. Examples of these observations are shown below. SPRI developed the gutter test standard to address this issue. The wind resistance tests included in this standard measure the resistance of the gutter system to wind forces acting outwardly (away from the building) and to wind forces acting upwardly tending to lift the gutter off of the building. The standard also measures the resistance of the gutter system to static forces of water, snow and ice acting downward. The six figures at the end of this reason statement are examples of gutter failures during high wind events observed during investigations conducted by the Roofing Industry Committee on Weather Issues (RICOWI).

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/>.









HICKMAN: This proposal requires that gutters that are used as part of the edge securement of single-ply roof membranes be tested to the appropriate standard for acceptable wind resistance performance.

Studies of the aftermath of high-wind events revealed that many gutter systems did not resist the loads that occur during these high-wind events. When gutters are used to secure the roof membrane, a gutter failure can become a much bigger problem as it can cause a roof failure. Examples of these observations are shown below.

SPRI developed the gutter test standard to address this issue. The wind resistance tests included in this standard measure the resistance of the gutter system to wind forces acting outwardly (away from the building) and to wind forces acting upwardly tending to lift the gutter off of the building. Following are examples of gutter failures during high wind events observed during investigations conducted by the Roofing Industry Committee on Weather Issues (RICOWI).





2.11-2. Membrane peeled away from the insulation and detached from the roof in most



2.11-10. Photo of gutter/cleat attachment is a good example of damage progression.



3-08-1. Small retail building. Close up of windblown, deflected gutter.



3-08-2. Small retail building. Roof view of lifted gutter and metal edge. Note roof membrane has not peeled back.



3-09-2. Large retail building. Gutter metal blew across the roof, puncturing the roof membrane and breaking skylights.



3-09-3. Large retail building. Broken skylights became wind-borne debris, puncturing roof membrane—SE view.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

KULIK: Even though there would be some increased cost to the manufacturer due to the testing of the gutter, it would be negligible, estimated around \$0.058 /LF. This would be a one-time cost amortized over production time of the gutter. The nominal cost would most likely not increase the cost of construction. Not every gutter is required to be tested (depends on profile and attachment type). Once the gutter is tested, it is good forever so the cost of the test is spread out over time and over all the feet of gutter produced.

HICKMAN: The code change proposal will not increase or decrease the cost of construction. This would be a one-time cost amortized over production time of the gutter. Once the gutter is tested, it is good forever so the cost of the test is spread out over time and over all the feet of gutter produced. Even though there would be some increased cost to the manufacturer due to the testing of the gutter, it would be negligible, less than \$0.05 /LF. Not every gutter is required to be tested (depends on profile and attachment type).

Staff Analysis: A review of the standard proposed for inclusion in the code, SPRIGT-1-2016 , with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S17-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that the gutter flange or drop are typically not tested. Unclear on the term 'extreme gutter'. The committee

felt it was inappropriate to have gutters in two different places in the code. The committee asked the proponent if gutter replacement requires a permit and were told 'no'. (Vote: 9-5)

Assembly Action:

None

S17-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1504.5.1 (New)

Proponents:

Amanda Hickman, representing Single-Ply Roofing Industry (SPRI) (amanda@thehickmangroup.com)

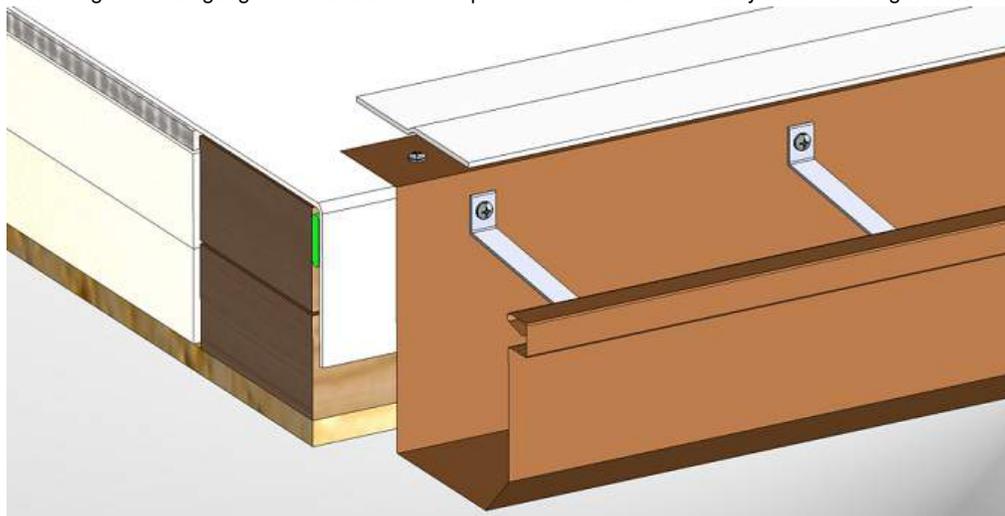
requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1504.5.1 Gutter securement for low-slope roofs. External Gutters that are used to secure the perimeter edge of the roof membrane on low-slope (less than 2:12 slope) built-up, modified bitumen, and single ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

Commenter's Reason: This comment clarifies the intent of the original proposal. It also addresses the committees concerns regarding the location of the edge. This language is needed in order to prevent roof failure caused by blow-off of a gutter that is used to secure a roof membrane.



Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment does not have a cost impact, as it is editorial in nature.

Public Comment# 1252

Public Comment 2:

IBC@: 1504.5.1 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1504.5.1 Gutter securement for low-slope roofs. ~~External gutters~~ Gutters that are used to secure the perimeter edge of the roof membrane on low-slope (less than 2:12 slope) built-up, modified bitumen, and single ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

Commenter's Reason: Members of BCAC as well as a number of stakeholders discussed both the need for and the specific language of this proposal at great lengths. To address the committee and stakeholder feedback only minor editorial changes have been made in this public comment. Low slope roofs that use gutters as a means to completely or in some part secure the perimeter edge of the roof membrane (see Figure 1) can be particularly vulnerable to roof failure. Therefore, it is critical that where a gutter blow-off could cause a roof membrane failure, the gutter needs to be tested appropriately for resistance to wind load.

All new construction and reroof projects must be permitted. Anytime a new gutter is included in the scope of that work, it is part of the submitted plans for permit. The proposed language is easily enforceable and will lead to safer better performing roofs.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommitteebcac>.



Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Even though there would be some increased cost to the manufacturer due to the testing of the gutter, it would be negligible, estimated around \$0.058 /LF. This would be a one-time cost amortized over production time of the gutter. The nominal cost would most likely not increase the cost of construction. Not every gutter is required to be tested (depends on profile and attachment type). Once the gutter is tested, it is good forever so the cost of the test is spread out over time and over all the feet of gutter produced. performing roofs.

Public Comment# 1322

S21-19

IBC®: 1504.8, TABLE 1504.8

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting, representing self; Mike Fischer, representing The Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com); Ellen Thorp, EPDM Roofing Association

2018 International Building Code

Delete and substitute as follows:

~~**1504.8 Surfacing and ballast materials in hurricane-prone regions.** For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:~~

- ~~1. Aggregate used as surfacing for roof coverings.~~
- ~~2. Aggregate, gravel or stone used as ballast.~~

1504.8 Wind resistance of aggregate-surfaced roofs. Aggregate surfaced roofs shall comply with Table 1504.8.

**TABLE 1504.8
 MAXIMUM ALLOWABLE MEAN ROOF HEIGHT PERMITTED FOR BUILDINGS WITH AGGREGATE ON THE ROOF IN AREAS OUTSIDE A
 HURRICANE-PRONE REGION**

NOMINAL DESIGN WIND SPEED, V_{asf} (mph) ^{b, d}	MAXIMUM MEAN ROOF HEIGHT (ft) ^{a, e}		
	Exposure category		
	B	C	D
85	170	60	30
90	110	35	15
95	75	20	NP
100	55	15	NP
105	40	NP	NP
110	30	NP	NP
115	20	NP	NP
120	15	NP	NP
Greater than 120	NP	NP	NP

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. Mean roof height as defined in ASCE 7.
- b. For intermediate values of V_{asf} , the height associated with the next higher value of V_{asf} shall be used, or direct interpolation is permitted.
- c. NP = gravel and stone not permitted for any roof height.
- d. V_{asf} shall be determined in accordance with Section 1609.3.1.

TABLE 1504.8
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS^{a,b,c}

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C ^d								
		<=95	100	105	110	115	120	130	140	150	<=95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67) or ASTM D7655 (No.4)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Interpolation shall be permitted for mean roof height and parapet height.

b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.

c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.

d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

Reason: In summary, this proposal has the following features:

1. Updates Table 1504.8 to a "basic design wind speed" basis and eliminates use of ASD wind speed to be consistent with changes made throughout the IBC in previous cycle to correlate with newer wind maps based on "ultimate" wind speeds (now called basic design wind speed).
2. Provides an engineering and scientific basis for roof design to prevent aggregate blow-off based on over 200 wind tunnel tests coupled with subsequent field studies from several different hurricane events with documented conditions and performance. See Bibliography (Kind-Wardlaw, 1976; Kind, 1977; Crandell & Smith, 2009; Crandell & Fischer, 2010; etc.)
3. Corrects unsafe conditions that the current Table 1504.8 allows based on scientifically incorrect assumptions (e.g., allows 170' tall buildings with aggregate surfaced roofs and NO PARAPET).
4. Accounts for aggregate size distribution in the referenced ASTM aggregate standards, including the minimum permitted aggregate size in the referenced mixes as addressed in the referenced wind tunnel studies for this proposal which replicated actual aggregate size distribution (Kind, 1977) as also confirmed in field studies (e.g., Crandell & Smith, 2009).
5. Has been independently confirmed by later field study subsequent to the original research with the purpose of verifying the accuracy and effectiveness of the design methodology based on actual performance of real buildings and real hurricane events (Morrison, 2011).

This proposal is consistent with S19-16 and a public comment (PC#2) that was submitted in response to the structural committee's direction in 2016. The public comment was approved at public hearing only to be spuriously overturned during the on-line governmental vote. What follows, for the record, are the reason statements from the original S19-16 proposal and PC#2 (with modest editing to fit the context of this proposal):

A) From the original S19-16 proposal (excerpt slightly edited):

The current provisions in Section 1504.8, and specifically Table 1504.8, are not based on the Kind-Wardlaw (K-W) design method (Kind Wardlaw 1976), the wind tunnel studies underlying the K-W design method (Kind 1977), or a quantitative analysis of observed good and bad roofing system

performances in real wind events. Instead, current building code requirements are based on variation in surface pressure with building height which is known to be an inappropriate predictor of aggregate blow-off or scour due to pressure equalization effects (Smith, 1997). Furthermore, these recent requirements do not address critical parameters such as aggregate size and parapet height which govern performance. This code change proposal replaces the current Table 1504.8 with one based on the K-W design method and new research by the Asphalt Roofing Manufacturers Association (ARMA) (Crandell and Fischer, 2010). Results demonstrate that the use of aggregate-surfaced roofing systems is a viable option in high wind areas with appropriate aggregate sizing and parapet design. The K-W design method has been simplified, improved, and calibrated to a number of field observations from actual hurricane events to refine its application to low-slope, built-up roof (BUR) and sprayed polyurethane foam (SPF) roof systems (Crandell Smith, 2009).

B) From PC2 on S19-16 (slightly edited):

In response to the structural committee's comments and indication that "this proposal is headed in the right direction", this public comment addresses the committee's recommendation to simplify and improve readability of the table (which was partly a font size or CDP access table formatting issue). These revisions are technically consistent with the original S19-16 proposal and the referenced research.

The 2016 committee also mentioned that questions were raised with regard to how the provisions were developed from the referenced research. The methodology (and design procedure) is clearly documented in the referenced research in an understandable, repeatable, and scientific manner (see original S19-16 proposal's reason statement (above) and bibliography (below) for referenced research reports and papers. The procedure used is consistent with the findings of many wind tunnel studies and uses the same principles as applied in the ANSI/SPRI RP-4 standard currently referenced in the code. It is also consistent with the treatment of aggregate blow-off as incorporated in wind risk models. Furthermore, the analytical procedure was evaluated by comparison to numerous documented field studies of successful and failed loose aggregate surfaced roofs systems in various high wind events to confirm its ability to reliably predict performance as a means to design roofs (or develop prescriptive provisions as proposed) to prevent roof aggregate blow-off. Thus, a robust combination of current engineering practice, wind tunnel data, and field research was used to support development of the requirements as proposed for Table 1504.8.

However, this proposal does not merely provide a more academic solution. It is necessary to correct deficiencies in the current code provisions. For example, the current Table 1504.8 allows buildings up to 170' tall or buildings in areas with design wind speeds up to 120 mph with NO PARAPET which creates a general safety hazard (e.g., falling debris from the roof) and unacceptable wind damage vulnerability (i.e., aggregate blow-off risk). This proposal corrects this safety and building performance issue based on correct scientific principles and sound engineering practices.

If implemented, this proposal will serve to prevent many past observations of roof aggregate blow-off from being repeated. Simply put, this proposal is implementing lessons learned in a rational, scientific manner based on real-world and wind tunnel laboratory data to prevent history from repeating itself in an unfavorable manner. Any argument against this proposal as being inadequate is an argument to leave the code in a far worse condition from a building safety and performance standpoint.

In closing, the following quote from Morrison (2011) provides independent, confirmation of the design methodology used for this proposal and is based on the documented performance (and aggregate and parapet conditions) of 20 buildings with aggregate surfaced roofs experiencing Hurricanes Francis and Jeanne in 2004:

"The major intent of this study was to determine the validity of Crandell's Modified Kind-Wardlaw Design Method for Buildings of All Heights [Crandell & Smith, 2009; Crandell & Fischer, 2010].

An X-value calculation was determined to compare the adjusted critical wind speed (V_{cr}) to the actual estimated wind speed (V_{roof}). Per Crandell's Method, a positive X-value would be "safe" from the standpoint of aggregate blow-off. Indeed, this was consistent with the observations.

In fact, Crandell's Method appears to be quite conservative since 12 of the 20 roofs observed had negative X-values but no observed or reported aggregate blow-off. The single roof that did experience blow-off had an X-value of -52. While this might suggest that Crandell's Method has a "safety factor" of about 50 mph wind speed, this is only one sample, and there were multiple uncertainties in this analysis."

In summary, this proposal is a significant improvement of the existing provisions in the code and will result in better performing and safer aggregate surfaced roofs based on a proven and robust design approach.

Bibliography: Crandell, J. H. and Smith, T.L.. (2009) Design Method Improvements to Prevent Roof Aggregate Blow -Off, Hurricane Hugo 20th Anniversary Symposium on Building Safer Communities – Improving Disaster Resistance, ATC-77, North Charleston, SC, October 22-23, 2009
Kind, R.J. and Wardlaw R.L. (1976). Design of Rooftops Against Gravel Blow -Off. National Aeronautical Establishment, National Research Council, Canada.

Kind, R.J. (1977). Further Wind Tunnel Tests on Building Models to Measure Wind Speeds at Which Gravel is Blown Off Rooftops. LTR-LA-189. National Aeronautical Establishment, National Research Council, Canada.

Smith, T.L. (June 1997). Aggregate Blow -Off from BUR and SPF Roofs: Recognizing the Potential Hazards and Avoiding Problems. Proceedings of The 8th U.S. Conference on Wind

Engineering, AAWE.

ANSI/SPRI RP-4 (2013). Wind Design Standard for Ballasted Single-Ply Roofing Systems. SPRI, Waltham, MA (www.spri.org)

Crandell, J. H. and Fischer, M. (2010). Winds of Change: Resolving Roof Aggregate Blow -Off, RCI 25th International Convention and Trade Show, March 25-30, 2010, RCI, Inc., Raleigh, NC

Morrison, R.V. (2011). Field Investigation of Aggregate Blow-off of Spray Polyurethane Foam Roofs, *RCI Interface*, Technical Journal of RCI, Inc. (presented at RICOWI Fall Symposium, November 11, 2010)

Cost Impact: The code change proposal will increase the cost of construction

Overall, the proposed new Table 1504.8 will provide additional options for use of aggregate surfaced roofs that are safer than the current provisions and which may reduce cost. In some cases, depending on current practice and the basic design wind speed condition for a building site, a parapet (or taller parapet) and/or larger aggregate may be required for compliance. In these cases, an incremental cost increase can be expected.

S21-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

2018 International Building Code

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for Aggregate surfaced roofs and shall comply with Table 1504.8.

TABLE 1504.8

MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS^{a,b,c}

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C ^d								
		<=95	100	105	110	115	120	130	140	150	<=95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67) or ASTM D7655 (No.4)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Interpolation shall be permitted for mean roof height and parapet height.

b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.

c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.

d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

Committee Reason: The proposal brings in the latest research into the code with wide insurance industry support. The modifications 1) corrects the aggregate size and 2) clarifies the proposal. (Vote: 13-1)

Assembly Action:

None

S21-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1504.8, TABLE 1504.8

Proponents:

Edwin Huston, representing National Council of Structural Engineers' Associations (NCSEA (huston@smithhustoninc.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.8.

**TABLE 1504.8
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS^{a,b,c}**

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C ^d								
		<=95	100	105	110	115	120	130	140	150	<=95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. Interpolation shall be permitted for mean roof height and parapet height.
- b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.
- c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.
- d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).
- e. Where the topographic factor (Kzt), as determined in accordance with ASCE 7 Section 26.8, is greater than 1.0, Additional calculations are required to determine parapet height.

Commenter's Reason: When applicable, the topographic factor Kzt can have a significant impact of the wind forces applied to a structure. The parapet height will need to be accordingly increased as a result of the higher wind forces. The footnote is added to put the individual selecting the parapet height on notice of the needed analysis.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. However, overall safety will be improved.

Public Comment# 2123

Public Comment 2:

IBC®: 1504.8, TABLE 1504.8

Proponents:

Edwin Huston, representing National Council of Structural Engineers' Associations (NCSEA (huston@smithhustoninc.com))

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.8.

**TABLE 1504.8
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS^{a,b,c}**

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C ^d								
		<=95	100	105	110	115	120	130	140	150	<=95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. Interpolation shall be permitted for mean roof height and parapet height.
- b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.
- c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.
- d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).
- e. Any section of a roof requiring a parapet to conform with the table, shall have a parapet, or an adjacent wall which is taller than the parapet, on all sides. The minimum parapet height on any section of a roof shall be determined at the highest elevation where the parapet and roof intersect. Other portions of the parapet, on any section of a roof, shall have a height greater than this minimum, due to roof slope.

Commenter's Reason: The Table doesn't have provisions for stepped roofs. Literature referenced by the proponents, discussed averaging the parapet heights between high points and low points. In many cases, parapets are only placed on three sides of the roof of single story commercial buildings. After Hurricane Wilma, the commenter observed roofing and other debris which had been blown off the back side of such buildings

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction However public safety will be improved.

Public Comment# 2126

Public Comment 3:

IBC@: 1504.8, TABLE 1504.8

Proponents:

Edwin Huston, representing National Council of Structural Engineers' Associations (NCSEA (huston@smithhustoninc.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.8. Aggregate-surfaced roofs shall be designed to sustain localized loads from aggregate drifts that form around the perimeter of the parapet.

**TABLE 1504.8
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS^{a,b,c}**

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C ^d								
		<=95	100	105	110	115	120	130	140	150	<=95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. Interpolation shall be permitted for mean roof height and parapet height.
- b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.
- c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.
- d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

Commenter's Reason: Similar to the provisions for snow drift contained in ASCE 7-16 Section 7.7, where the aggregate is restrained from blow-off by the parapet it is possible that significant aggregate weight can build up in localized areas. With allowable parapet heights of up to 56 inches, the "aggregate drift" that can build up along the parapet can be significantly larger than the roof design dead and live loading. The effect of this weight should be accounted for in the design of the roof and parapet framing.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. However there will be an increase in safety.

S23-19

IBC®: 1507.1.1, TABLE 1507.1.1(1), ASTM Chapter 35 (New)

Proposed Change as Submitted

Proponents: Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

2018 International Building Code

Revise as follows:

1507.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869, ~~and D6757~~ and ASTM WK51913 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). Underlayment shall be applied in accordance with Table 1507.1.1(2). Underlayment shall be attached in accordance with Table 1507.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer modified bitumen underlayment complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer modified bitumen membrane complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph (54 m/s) shall be applied over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of underlayment complying with ASTM D226 Type II ~~or~~, ASTM D4869 Type IV, ASTM WK51913 shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment ~~felt~~, overlapping successive sheets 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm). Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (mm). The cap nail shank shall be not less than 0.083 inch for ring shank cap nails and 0.091 inch (mm) for smooth shank cap nails. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than ³/₄ inch (19.1 mm) into the roof sheathing.
4. Structural metal panels that do not require a substrate or underlayment.

**TABLE 1507.1.1(1)
UNDERLAYMENT TYPES**

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, V < 140 MPH	MAXIMUM BASIC DESIGN WIND SPEED, V ≥ 140 MPH
Asphalt shingles	1507.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757 <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757 <u>ASTM WK51913</u>
Clay and concrete tiles	1507.3	ASTM D226 Type II <u>ASTM WK51913</u> ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing	ASTM D226 Type II <u>ASTM WK51913</u> ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing
Metal panels	1507.4	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type IV <u>ASTM WK51913</u>
Metal roof shingles	1507.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV <u>ASTM WK51913</u>
Mineral-surfaced roll roofing	1507.6	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV <u>ASTM WK51913</u>
Slate shingles	1507.7	ASTM D226 Type II ASTM D4869 Type III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV <u>ASTM WK51913</u>
Wood shingles	1507.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV <u>ASTM WK51913</u>
Wood shakes	1507.9	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV_ <u>ASTM WK51913</u>
Photovoltaic shingles	1507.17	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757 <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757_ <u>ASTM WK51913</u>

Add new text as follows:

WK51913: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This proposal references an ASTM Work Item for a new ASTM Standard that will apply exclusively to synthetic underlayments. The proposal simply stipulates new performance requirements for products that are already in widespread use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal references a proposed ASTM Standard that will, for the first time, apply specific performance requirements to synthetic underlayment products that are already in widespread use and will therefore not affect the cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S23-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Proponent requested disapproval. The provided reference standard was incomplete (WK version). (Vote: 14-0)

Assembly Action: **None**

S23-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

requests As Submitted

Commenter's Reason: The ASTM Work Item is still in process but there is a good chance that we will have a published standard prior to the FAH in October. This will establish a standard that relates directly to synthetic underlayments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal only adds a referenced standard that applies directly and specifically to synthetic underlayments. Thus, there is no cost impact.

Staff Analysis: In accordance with Section 3.6.3.1 of ICC Council Policy 28, the new referenced standard ASTM WK51913-2019, *Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing*, must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

Public Comment# 2011

S26-19

IBC@: 1507.8.1

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Building Code

Revise as follows:

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. The spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other material.

Reason: Shingles installed over spaced sheathing have underlayment that interweaves with the shingles and is subject to wetting. Although most drying of the underlayment is to the outside, there is some drying that must occur into the building. Spray foam prevents this drying, allowing moisture to accumulate below the shingle. Direct backing of the shingle with insulating foam also raises the temperature of the shingle and accelerates deterioration.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This change is primarily to stop a practice that often occurs as a retrofit. It is not a normal part of any construction process or system, but can sometimes be added to a building interior during modifications.

S26-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The code change proposal was unclear and would most likely increase the cost of construction (contrary to the provided 'cost impact' statement).

(Vote: 14-0)

Assembly Action:

None

S26-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1507.8.1

Proponents:

David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. ~~The spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other material.~~ When wood shingles are installed over spaced sheathing the attic shall be ventilated in accordance with Section 1202.2.2 and shall not be backed with materials that prevents the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: In this case the spaced sheathing serves as the roof deck, so I believe this wording belongs in 1507.8.1. **The alternative placement of this requirement is Chapter 12, but as the issue is having the inside surface of the shingle open to air movement to remove moisture that permeates the wood, the installation and requirement is most likely understood by the roofer. Placing anything that traps moisture in the shingle will shorten the shingles useful life.** Although most drying of the shingles is to the outside, there is some drying that must occur into the building. Any material that prevents the free movement of air on the interior side of the spaced sheathing prevents this drying, allowing moisture to accumulate in the bottom layer of shingles and accelerates wood deterioration. Direct backing of the shingle with insulating material of any type also raises the temperature of the shingle, changes the differential between interior and exterior temperature and accelerates deterioration.

Bibliography: Jerrold E. Winand, H. Michael Barnes, Robert H. Falk; Summer temperatures of roof assemblies using western redcedar, wood-thermoplastic composite, or fiberglass shingles: FOREST PRODUCTS JOURNAL Vol. 54, No. 11

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This change is primarily to stop a practice that occurs in new construction and as a retrofit. Insulation and or other barrier products are sometimes added to a building attic interior directly to the interior side of wood shingles. The cost of installation and future problems associated with deterioration of the wood will be eliminated if the material that prevents moisture movement is not installed and the system is free to breathe and dry. So in this case there is a savings in material and installation cost.

Public Comment# 1522

S27-19

IBC@: 1507.8.6, 1507.9.7

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Building Code

Revise as follows:

1507.8.6 Attachment. Fasteners for wood shingles shall be ~~corrosion resistant with hot dipped galvanized box nails, or Type 304 stainless steel box nails.~~ Where used within 15 miles of salt water coasts stainless steel box nails shall be Type 316. Fasteners for Fire retardant treated shingles or pressure impregnated preservative shingles shall be stainless steel type 316. Fasteners shall have a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with not fewer than two fasteners.

1507.9.7 Attachment. Fasteners for wood shakes shall be ~~corrosion resistant with hot dipped galvanized, or Type 304 stainless steel box nails.~~ Where used within 15 miles of salt water coasts stainless steel box nails shall be Type 316. Fasteners for fire retardant treated shakes or pressure impregnated preservative treated shakes shall be stainless steel Type 316. Fasteners shall have a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with not fewer than two fasteners.

Reason: This change is to harmonize the text in 1507.8.6 and 1507.9.7 of the code, with the requirements in Table 1507.8 and have the same requirements in the IBC as in the IRC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This change is primarily to stop a practice that often occurs as a retrofit. It is not a normal part of any construction process or system, but can sometimes be added to a building interior during modifications.

S27-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee was unclear of the term 'saltwater coast' - needs definition.
(Vote: 14-0)

Assembly Action:

None

S27-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1507.8.6, 1507.9.7

Proponents:

David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1507.8.6 Attachment. Fasteners for wood shingles shall be hot dipped galvanized box nails, or Type 304 stainless steel box nails. Where used within 15 miles of salt water coasts stainless steel box nails shall be Type 316. Fasteners for Fire retardant treated shingles or pressure

impregnated preservative shingles shall be stainless steel type 316. Fasteners shall have a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, furthermore the fasteners shall extend through the sheathing. Each shingle shall be attached with not fewer than two fasteners.

1507.9.7 Attachment. Fasteners for wood shakes shall be hot dipped galvanized, or Type 304 stainless steel box nails. Where used within 15 miles of salt water coasts stainless steel box nails shall be Type 316. Fasteners for fire retardant treated shakes or pressure impregnated preservative treated shakes shall be stainless steel Type 316, Fasteners shall have a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, furthermore the fasteners shall extend through the sheathing. Each shake shall be attached with not fewer than two fasteners.

Commenter's Reason: This change is to harmonize the text in 1507.8.6 and 1507.9.7 of the IBC code, with the requirements in Table 1507.8 and have the same requirements in the IBC as in the 2018 IRC Sections 905.8.6 and 905.8.7. Currently Table 1507.8 requires Type 316 Stainless Steel for coastal areas, and the manufacturers requirements specify that Type 316 Stainless Steel is required within 15 miles of water and when fire retardant or pressure treated shingles or shakes are installed. Although Table 1507.8 is a great pointer to the requirements for installation near salt water it does not cover the requirements for pressure impregnated fire retardant treated and preservative treated wood products. The wording in the proposed change makes the requirements clear and enforceable. The Stainless Steel Institute makes it clear for optimum life of stainless products Type 316 is to be used in areas within 15 miles of water. Jurisdictions where this is not seen as an issue can exclude this requirement for their local code. The salt water coast is easily defined by the local code official. The 15 mile inland distance is easily measured with current online mapping technology.

The issue is based on the fact that wind blown salt spray can travel long distances and deteriorate stainless steel fasteners. Fasteners failure will result in loss of wood shingles or shakes resulting in potential interior water damage.

The IRC and the IBC should be harmonized for the EXACT SAME products. Despite prior code cycle attempts requesting harmonization, the CSSB has yet to see the needed response from ICC.

Consumer safety is impacted when fasteners fail and the roof slides down the deck. Consumer wallets are affected when fasteners fail and the roof starts to leak. Roofing products are unfairly blamed when fasteners fail and the fastener manufacturer will not take responsibility.

The CSSB respectfully asks that ICC harmonize the IBC with the IRC code, using the more stringent fastener requirement ALREADY LISTED in IRC, to ensure consumers and manufacturers are both protected from needless fastener failures. There is an urgent need to ensure this harmonization is implemented and the CSSB finds it difficult to understand why product durability requirements, that are based on field experience, and the recommendations of the Stainless Steel institute have not been supported.

Bibliography: Cedar Shake and Shingle Bureau New Roof Construction Manual
Stainless Steel designer Handbook for Coastal and Salt Corrosion

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The requirements as noted in this code change were first included in Table 1507.8 in the IBC in 2015, but the text did not match the table. The International Residential Code text in sections 905.8.6 and 905.7.5 beginning in the 2015 version requires that hot dipped galvanized, or stainless fasteners be used. This use of hot dipped galvanized or stainless steel was defined and has been required in the manufacture's installation literature since 2010. (Cedar Shake and Shingle Bureau; New Roof Construction Manual) Therefore code compliance has required the use of this grade of fastener, and therefore the change will not add to the cost of construction. This change is only to note that the table is correct and that the text should match.

The change also helpfully defines how far in from the coast this type of fastener is required and harmonizes the two major construction codes promoted by ICC.

Public Comment# 1518

S29-19

IBC®: 1507.9.1

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Building Code

Revise as follows:

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. The spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other material.

Reason: Shakes installed over spaced sheathing have underlayment that interweaves with the shakes and is subject to wetting. Although most drying of the underlayment is to the outside; there is some drying that must occur into the building. Spray foam prevents the drying, allowing moisture to accumulate below the shake. Direct backing of the shake with insulating foam also raises the temperature of the shake and accelerates deterioration.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The requirements as noted in this code change were first included in Table 1507.8 in the IBC in 2015, but the text did not match the table. The International Residential Code text in sections 905.8.6 and 905.7.5 beginning in the 2015 version requires that hot dipped galvanized, or stainless fasteners be used. This use of hot dipped galvanized or stainless steel was defined and has been required in the manufacturer's installation literature since 2010. (Cedar Shake and Shingle Bureau; New Roof Construction Manual) Therefore code compliance has required the use of this grade of fastener, and therefore the change will not add to the cost of construction. This change is only to note that the table is correct and that the text should match.

S29-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent requested disapproval based on action on S26. Committee action is consistent with action on S26. (Vote: 14-0)

Assembly Action:

None

S29-19

Individual Consideration Agenda

Public Comment 1:

IBC®: 1507.9.1

Proponents:

David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards

shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. ~~The spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other material.~~ When wood shakes are installed over spaced sheathing the attic shall be ventilated in accordance with Section 1202.2.2, the shakes shall not be backed with materials that prevents the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: In this case the spaced sheathing serves as the roof deck, so I believe this wording belongs in Section 1507.8.1. **The alternative placement of this requirement is Chapter 12, but as the issue is having the building interior surface of the shake open to air movement to remove moisture that permeates the wood, the installation and requirement is most likely understood by the roofer. Placing anything that traps moisture in the shake will shorten the shakes useful life.** Although most drying of the shake is to the outside, there is some drying that must occur into the building. Any material that prevents the free movement of air on the interior side of the spaced sheathing prevents this drying, allowing moisture to accumulate in the bottom layer of shakes and accelerates wood deterioration. Direct backing of the shakes with insulating material of any type also raises the temperature of the shake, changes the differential between interior and exterior temperature of the shake and accelerates deterioration.

Bibliography: Jerrold E. Winand, H. Michael Barnes, Robert H. Falk; Summer temperatures of roof assemblies using western redcedar, wood-thermoplastic composite, or fiberglass shingles: FOREST PRODUCTS JOURNAL Vol. 54, No. 11

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This change is primarily to stop a practice that occurs in new construction and as a retrofit. Insulation and or other barrier products are sometimes added to a building attic interior directly to the interior side of wood shakes. The cost of installation and future problems associated with deterioration of the wood will be eliminated if the material that prevents moisture movement is not installed and the system is free to breathe and dry. So in this case there is a savings in material and installation cost.

Public Comment# 1525

S37-19

IBC: 1602.1, 1605.2, 1605.2.1, 1605.3.1, 1605.3.1.1

Proposed Change as Submitted

Proponents: Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (KCobeen@wje.com); Jennifer Goupil, representing American Society of Civil Engineers (ASCE) (jgoupil@asce.org); Michael Mahoney, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

2018 International Building Code

Revise as follows:

1602.1 Notations. D = Dead load.

D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.

E = Combined effect of horizontal and vertical earthquake induced forces as defined in Chapter 12 Section 2.3.6 of ASCE 7.

E_h = Effect of horizontal seismic forces as determined in Chapter 12 of ASCE 7.

E_{mh} = Effect of horizontal seismic forces including overstrength as determined in Chapter 12 of ASCE 7.

E_v = Vertical seismic effect applied in the vertical downward direction as in determined in Chapter 12 of ASCE 7.

F = Load due to fluids with well-defined pressures and maximum heights.

F_a = Flood load in accordance with Chapter 5 of ASCE 7.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Roof live load greater than 20 psf (0.96 kN/m²) and floor live load.

L_r = Roof live load of 20 psf (0.96 kN/m²) or less.

R = Rain load.

S = Snow load.

T = Cumulative effects of self-straining load forces and effects.

V_{asd} = Allowable stress design wind speed, miles per hour (mph) (km/hr) where applicable.

V = Basic design wind speeds, miles per hour (mph) (km/hr) determined from Figures 1609.3(1) through 1609.3(8) or ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

1605.2 Load combinations using strength design or load and resistance factor design. Where strength design or load and resistance factor design is used, buildings and other structures, and portions thereof, shall be designed to resist the most critical effects resulting from the following combinations of factored loads:

1.4(D + F) (**Equation 16-1**)

1.2(D + F) + 1.6(L + H) + 0.5(L_r or S or R) (**Equation 16-2**)

1.2(D + F) + 1.6(L_r or S or R) + 1.6H + (f_1L or 0.5W) (**Equation 16-3**)

1.2(D + F) + 1.0W + f_1L + 1.6H + 0.5(L_r or S or R) (**Equation 16-4**)

~~1.2(D + F) + 1.0E + f_1L + 1.6H + f_2S (**Equation 16-5**)~~

$0.9D + 1.0W + 1.6H$ (Equation 16-5 6)

$0.9(D + F) + 1.0E + 1.6H$ (Equation 16-7)

where:

$f_1 = 1$ for places of public assembly live loads in excess of 100 pounds per square foot (4.79 kN/m²), and parking garages; and 0.5 for other live loads.

$f_2 = 0.7$ for roof configurations (such as saw tooth) that do not shed snow off the structure, and 0.2 for other roof configurations.

Exceptions:

1. Where other factored load combinations are specifically required by other provisions of this code, such combinations shall take precedence.
2. Where the effect of H resists the primary variable load effect, a load factor of 0.9 shall be included with H where H is permanent and H shall be set to zero for all other conditions.

Add new text as follows:

1605.2.1 Load combinations with seismic load effects. Where a structure is subject to seismic load effects, the following load combinations shall be considered in addition to the basic combinations in Section 1605.2. The most unfavorable effects from seismic loads shall be investigated, where appropriate. The seismic loads need not be considered to act simultaneously with wind loads.

Where the prescribed seismic load effect is combined with the effects of other loads, the following seismic load combinations shall be used:

$1.2(D + F) + 1.0E_v + 1.0E_h + f_1L + 1.6H + f_2S$ (Equation 16-6)

$0.9(D + F) - 1.0E_v + 1.0E_h + 1.6H$ (Equation 16-7)

Where the seismic load effect with overstrength is combined with the effects of other loads, the following seismic load combinations shall be used:

$1.2(D + F) + 1.0E_v + 1.0E_{mh} + f_1L + 1.6H + f_2S$ (Equation 16-8)

$0.9(D + F) - 1.0E_v + 1.0E_{mh} + 1.6H$ (Equation 16-9)

where:

$f_1 = 1$ for places of public assembly live loads in excess of 100 pounds per square foot (4.79 kN/m²), and parking garages; and 0.5 for other live loads.

$f_2 = 0.7$ for roof configurations (such as saw tooth) that do not shed snow off the structure, and 0.2 for other roof configurations.

Exceptions:

1. Where other factored load combinations are specifically required by other provisions of this code, such combinations shall take precedence.
2. Where the effect of H resists the primary variable load effect, a load factor of 0.9 shall be included with H where H is permanent and H shall be set to zero for all other conditions.

Revise as follows:

~~1605.2.1~~ **1605.2.2 Other loads.** Where flood loads, F_a , are to be considered in the design, the load combinations of Section 2.3.2 of ASCE 7 shall be used. Where self-straining loads, T , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.3.4 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.3.3 of ASCE 7 shall be considered.

1605.3 Load combinations using allowable stress design. Load combinations for allowable stress design shall be in accordance with Section 1605.3.1 or 1605.3.2.

Revise as follows:

1605.3.1 Basic load combinations. Where allowable stress design (working stress design), as permitted by this code, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

$D + F$

(Equation 16-8 10)

$$D + H + F + L$$

(Equation 16-9 11)

$$D + H + F + (L, \text{ or } S \text{ or } R)$$

(Equation 16-10 12)

$$D + H + F + 0.75(L) + 0.75(L, \text{ or } S \text{ or } R)$$

(Equation 16-11 13)

$$D + H + F + (0.6W \text{ or } 0.7E) \text{ (Equation 16-12 14)}$$

$$D + H + F + 0.75(0.6W) + 0.75L + 0.75(L, \text{ or } S \text{ or } R)$$

(Equation 16-13 15)

$$D + H + F + 0.75(0.7E) + 0.75L + 0.75L + 0.75S \text{ (Equation 16-14)}$$

$$0.6D + 0.6W + H$$

(Equation 16-15 16)

$$0.6(D + F) + 0.7E + H \text{ (Equation 16-16)}$$

Exceptions:

1. Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 psf (1.44 kN/m²) or less and roof live loads of 30 psf (1.44 kN/m²) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m²), 20 percent shall be combined with seismic loads.
3. Where the effect of H resists the primary variable *load effect*, a load factor of 0.6 shall be included with H where H is permanent and H shall be set to zero for all other conditions.
4. In Equation 16-15, the wind load, W , is permitted to be reduced in accordance with Exception 2 of Section 2.4.1 of ASCE 7.
5. In Equation 16-16, $0.6D$ is permitted to be increased to $0.9D$ for the design of special reinforced masonry shear walls complying with Chapter 21.

Add new text as follows:

1605.3.1.1 Load combinations with seismic load effects. When a structure is subject to seismic load effects, the following load combinations shall be considered in addition to the basic combinations in Section 1605.3.1. The most unfavorable effects from seismic loads shall be investigated, where appropriate, but they need not be considered to act simultaneously with wind loads.

Where the prescribed seismic load effect is combined with the effects of other loads, the following seismic load combinations shall be used:

$$D + H + F + 0.7E_v + 0.7E_h \text{ (Equation 16-17)}$$

$$D + H + F + 0.525E_v + 0.525E_h + 0.75(L) + 0.75(L_r \text{ or } S \text{ or } R) \text{ (Equation 16-18)}$$

$$0.6(D + F) - 0.7E_v + 0.7E_h + H \text{ (Equation 16-19)}$$

Where the seismic load effect with overstrength is combined with the effects of other loads, the following seismic load combinations shall be used:

$$D + H + F + 0.7E_v + 0.7E_{mh} \text{ (Equation 16-20)}$$

$$D + H + F + 0.525E_v + 0.525E_{mh} + 0.75(L) + 0.75(L_r \text{ or } S \text{ or } R) \text{ (Equation 16-21)}$$

$$0.6(D + F) - 0.7E_v + 0.7E_{mh} + H \text{ (Equation 16-22)}$$

Exceptions:

1. In Equations 16-18 and 16-21, flat roof snow loads of 30 psf (1.44 kN/m²) or less and roof live loads of 30 psf (1.44 kN/m²) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m²), 20 percent shall be combined with seismic loads.
2. Where the effect of H resists the primary variable *load effect*, a load factor of 0.6 shall be included with H where H is permanent and H shall be set to zero for all other conditions.
3. In Equation 16-19 and 16-22, $0.6D$ is permitted to be increased to $0.9D$ for the design of special reinforced masonry shear walls complying with Chapter 21.

Revise as follows:

~~1605.3.1.1~~ **1605.3.1.2 Stress increases.** Increases in allowable stresses specified in the appropriate material chapter or the referenced standards shall not be used with the load combinations of Section 1605.3.1, except that increases shall be permitted in accordance with Chapter 23.

~~1605.3.1.2~~ **1605.3.1.3 Other loads.** Where flood loads, F_a , are to be considered in design, the load combinations of Section 2.4.2 of ASCE 7 shall be used. Where self-straining loads, T , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.4.3 of ASCE 7 shall be considered.

Reason: This proposal modifies the load combinations of Sections 1605.2 and 1605.3.1 to more closely align with ASCE 7-16. This editorial change is intended to aid designers by incorporating the ASCE 7 change to more specifically present vertical and horizontal components of seismic loading. See Sections 1605.2.1 and 1605.3.1.1.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal is a clarification of the use of currently existing design provisions. It will not change the cost of construction. It may modestly decrease the cost of design by providing greater clarity.

S37-19

Public Hearing Results

Errata: This proposal includes unpublished errata

Exceptions:

1. Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load. .

~~2. Flat roof snow loads of 30 psf (1.44 kN/m~~

~~32. Where the effect of H resists the primary variable load effect, a load factor of 0.6 shall be included with H where H is permanent and H shall be set to zero for all other conditions.~~

43. In Equation 16-15, the wind load, W , is permitted to be reduced in accordance with Exception 2 of Section 2.4.1 of ASCE 7.

Committee Action:

Disapproved

Committee Reason: Disapproved based on action on S47.

(Vote: 14-0)

Assembly Action:

None

S37-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Submitted

Commenter's Reason: Changes to load combinations in ASCE 7-16 make it necessary to modify Chapter 16 load combinations to coordinate. Proposals S37-19 and S47-19 provided alternative ways to implement coordination. S47-19 was determined to be the preferred method, and was supported for approval at the CAH. This public comment for approval as submitted will allow for updating of load combinations, should proposal S47-19 not be approved at the final action hearings. If S47-19 is approved, the proponent intends to withdraw this public comment. See originally submitted statement of reason for further information.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. See original code change proposal for discussion.

S40-19

IBC: 1604.3

Proposed Change as Submitted

Proponents: Jennifer Goupil, American Society of Civil Engineers (ASCE), representing American Society of Civil Engineers (ASCE) (jgoupil@asce.org)

2018 International Building Code

Revise as follows:

SECTION 1604 GENERAL DESIGN REQUIREMENTS

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3. ~~Drift limits applicable to earthquake loading shall be in accordance with ASCE 7 Chapter 12, 13, 15 or 16, as applicable.~~

Reason: This sentence regarding drift limits does not belong in the section for serviceability. Serviceability and the referenced Table define requirements due to non-lateral loading. The requirements for drift from lateral loads are defined in Section 1613, along with all of the other requirements for lateral loading.

This change is not a technical change in the requirements, rather a clarification of the content of the requirements for Serviceability.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There is no technical change from this proposal, but a clarification of the appropriate content in this section on serviceability. The drift limit requirements are already included in Section 1613 Earthquake Loading.

S40-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This change is not a technical change in the requirements, rather a clarification of the content of the requirements for Serviceability.

(Vote: 14-0)

Assembly Action:

None

S40-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1604.3, 1613.1

Proponents:

Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3.

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their

supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. Drift limits applicable to earthquake loading shall be in accordance with ASCE 7 Chapter 12, 13, 15 or 16, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S , is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.

Commenter's Reason: The original code change deleted requirements to check drift limits using ASCE 7 because the requirements were in the wrong section. Drift limits for earthquake are not necessarily serviceability requirements, I agree. However this is an important statement that should be included somewhere. So it is proposed that instead of completely deleting the sentence, it be moved back to Section 1613.1.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There should be no effect on construction, this proposal is just proposing to move the language about checking seismic drift from the Serviceability section to the Earthquake Loads section.

Public Comment# 2157

S44-19

IBC@: TABLE 1604.5

Proposed Change as Submitted

Proponents: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development Committee (lkranz@bellevuewa.gov)

2018 International Building Code

Revise as follows:

**TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

Portions of table not shown remain unchanged.

RISK CATEGORY	NATURE OF OCCUPANCY
III	<p>Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:</p> <ul style="list-style-type: none"> •Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. <p><u>Buildings and other structures containing one or more public assembly spaces with an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500.</u></p> <ul style="list-style-type: none"> •Buildings and other structures containing Group E occupancies with an occupant load greater than 250. •Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. •Group I-2, Condition 1 occupancies with 50 or more care recipients. •Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. •Group I-3 occupancies. •Any other occupancy with an occupant load greater than 5,000.^a •Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. •Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the International Fire Code; and Are sufficient to pose a threat to the public if released.^b

- a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.
- b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: There are examples of R-1 hotel buildings having multiple large ball rooms or other public assembly spaces but “public assembly” is not the “primary occupancy” as is currently specified in Table 1604.5 so these buildings are classified as Risk Category II. Conversely, there are smaller stand-alone buildings where the primary occupancy is “public assembly” with an occupant load just over 300 that must be designed to the higher Risk Category III even though the total occupant load is much smaller when compared with the example above. This proposal adds a new criteria for buildings containing at least one assembly space of 300 or more and also having a cumulative occupant load of all assembly spaces of 2,500 or more. This proposal would not include buildings that have multiple assembly spaces, each with an occupant load of less than 300 (like a movie theatre), in Risk Category III unless the total occupant load of the building was greater than 5,000 people. It would also not include a building having multiple assembly spaces, each with an occupant load greater than 300 but the cumulative occupant load of the assembly spaces were less than 2,500, unless the primary occupancy was public assembly or the total occupant load of the building was greater than 5,000 people.

If approved, buildings having one or more assembly rooms with an occupant load of 300 or more and a cumulative occupant load of public assembly spaces of 2,500 or more would be classified as Risk Category III.

Cost Impact: The code change proposal will increase the cost of construction
If approved, more buildings will fall under the Risk Category III which will add cost to construct the building due to a higher importance factor.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
2018 International Building Code

TABLE 1604.5

RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
III	<p>Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:</p> <ul style="list-style-type: none"> •Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. <p>Buildings and other structures containing one or more public assembly spaces <u>with each having</u> an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500.</p> <ul style="list-style-type: none"> •Buildings and other structures containing Group E occupancies with an occupant load greater than 250. •Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. •Group I-2, Condition 1 occupancies with 50 or more care recipients. •Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. •Group I-3 occupancies. •Any other occupancy with an occupant load greater than 5,000.^a •Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. •Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: <ul style="list-style-type: none"> Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the International Fire Code; and Are sufficient to pose a threat to the public if released.^b

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Committee Reason: The proposal provides a reasonable threshold for when to trigger risk category 3. The modification clarifies the intent. (Vote: 13-1)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: TABLE 1604.5

Proponents:

Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development Committee
(lkranz@bellevuewa.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

**TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

RISK CATEGORY	NATURE OF OCCUPANCY
III	<p>Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:</p> <ul style="list-style-type: none"> •Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. •Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the <u>these</u> public assembly spaces of greater than 2,500. •Buildings and other structures containing Group E occupancies with an occupant load greater than 250. •Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. •Group I-2, Condition 1 occupancies with 50 or more care recipients. •Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. •Group I-3 occupancies. •Any other occupancy with an occupant load greater than 5,000.^a •Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. •Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the International Fire Code; and Are sufficient to pose a threat to the public if released.^b

- a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.
- b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Commenter's Reason: This public comment is to follow up on a suggestion by one of the ICC Structural Committee members to change "the" to "these" in the proposed criteria for Risk Category III. This change will make it clear that only public assembly spaces with an occupant load of 300 or more are to be included in determining if the cumulative occupant load exceeds 2,500.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Very few projects will be impacted by this code change but for those that do the cost will be higher due to the structural design having to meet higher lateral force demands of Risk Category III.

S52-19

IBC: SECTION 106, 106.1, 106.2, 106.3, 111.5 (New), SECTION 1607 (New), 1607.1 (New), 1607.7.5

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Building Code

Delete without substitution:

SECTION 106 FLOOR AND ROOF DESIGN LOADS

~~**[A] 106.1 Live loads posted.** In commercial or industrial buildings, for each floor or portion thereof designed for live loads exceeding 50 psf (2.40 kN/m²), such design live loads shall be conspicuously posted by the owner or the owner's authorized agent in that part of each story in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.~~

~~**[A] 106.2 Issuance of certificate of occupancy.** A certificate of occupancy required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.~~

~~**[A] 106.3 Restrictions on loading.** It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.~~

Revise as follows:

SECTION 111 CERTIFICATE OF OCCUPANCY

Add new text as follows:

111.5 Live load posted. A certificate of occupancy required shall not be issued until floor load signs, where required by Section 1607.1.1, and maximum weight of vehicles, where required by Section 1607.7.5, have been posted.

SECTION 1607 LIVE LOADS

1607.1 General. Live loads are those loads defined in Chapter 2 of this code.

1607.1.1 Live loads posted. In commercial or industrial buildings, for each floor or portion thereof designed for live loads exceeding 50 psf (2.40 kN/m²), such design live loads shall be posted in a readily visible location by the owner or the owner's authorized agent in the portion of each story in which they apply. It shall be unlawful to remove or deface such notices.

Revise as follows:

1607.7 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.7.1 through 1607.7.5.

1607.7.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in ~~accordance with Section 106.1,~~ a readily visible location at the vehicle entrance of the building or other approved location. It shall be unlawful to remove or deface such notices.

Reason: The purpose of this code change is to restore the live load posting requirements to Chapter 16. These provisions had been moved to Section 106 by proposal S48-07/08 on the basis that they were administrative requirements rather than technical requirements. The BCAC reviewed the provisions and determined they are in fact technical construction requirements, not administrative enforcement requirements. It is noted they are tied to specific loading requirements in Chapter 16 and are the responsibility of the owner to provide, not the building department. Thus these requirements should be relocated to Chapter 16, with a note left in Section 110 for the building department to verify the loads have been posted. The terminology "commercial or industrial buildings" is existing text that has been in place for several code cycles and B-CAC decided to leave it unchanged. Further, separate provisions have been created for floor live loads and maximum vehicle weights. The reference to a "readily visible" location parallel those for stairway identification signs (Section 1023.9) and signage for public toilet facilities (Section 2902.4 and 2902.4.1). It is noted this signage is not tied to egress or accessibility requirements for the space. Therefore, it is not necessary to require the sign comply with ICC A117.1 or otherwise meet legibility requirements.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This relocation of requirements may reduce the cost of construction because all necessary requirements are located in the appropriate Chapter.

S52-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal appears to be intended to be administrative provisions to be located in a design chapter. Section 1607.1.1 language needs revision for clarity on intent.
(Vote: 14-0)

Assembly Action:

None

S52-19

Individual Consideration Agenda

Public Comment 1:

IBC@: SECTION, [A], 1607.7, 1607.7.5

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

SECTION 106 FLOOR AND ROOF DESIGN LOADS

[A] ~~106.1 Live loads posted.~~ In commercial or industrial buildings, for each floor or portion thereof designed for *live loads* exceeding 50 psf (2.40 kN/m²), such design *live loads* shall be conspicuously posted by the owner or the owner's authorized agent in that part of each story in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.

[A] ~~106.2 Issuance of certificate of occupancy.~~ A certificate of occupancy required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.

[A] ~~106.3 Restrictions on loading.~~ It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.

1607.7 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.7.1 through 1607.7.5.

1607.7.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted in a readily visible location at the vehicle entrance of the building or other approved location by the owner or the owner's authorized agent ~~in accordance with Section 106.1.~~ It shall be unlawful to remove or deface such notices.

Commenter's Reason: There were concerns expressed by the committee with the current text:

- The requirement in Section 106.1 is too low of a weight load.
- This signage requirement is lost/hidden in Chapter 1.
- Inspectors never see it provided;
- If required there is no mechanism to make sure it is maintained.
- There is no specifics on what to do with the information provided.

The BCAC looked at increasing the weight requirements, but instead decided with the concerns raised that this requirement is better not in the code. Therefore, this public comment seeks to delete this signage requirement from Chapter 1.

Regarding the current language for garage posting currently in 1607.7.5. The current Section 106.1 referenced did not provide sufficient guidance. The committee had suggestions to improve the order of the new proposed language for additional clarity. Where this sign is required is very limited since it is only needed in parking areas inside a building for heavy vehicles.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This will eliminate the requirements for some signs.

Public Comment# 1183

S60-19

IBC®: 1603.1.1, TABLE 1607.1

Proposed Change as Submitted

Proponents: Paul Armstrong, MHI, representing MHI

2018 International Building Code

Revise as follows:

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.11 shall be indicated for each type of live load used in the design.

For Group S storage warehouses the floor shall be designed for the maximum uniformly distributed or concentrated live load. In areas with storage rack, the concentrated live load shall be designed for a minimum concentrated load of 5,000 lbs (2268 kg) where the clear ceiling height is 15 feet (4572 mm) minimum. The concentrated load shall be increased an additional 2,500 lbs (1123 kg) for each additional 5 feet (1524 mm) clear ceiling height or portion thereof, over 15 feet (4572 mm). The concentrated loads shall be located on a 4 foot by 8 foot (1219 mm by 2438 mm) grid over the floor area with storage racks.

**TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L₀, AND MINIMUM CONCENTRATED LIVE LOADS⁹**

Portions of table not shown remain unchanged.

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
31. Storage warehouses (shall be designed for heavier loads if required for anticipated storage)		<u>See Section 1603.1.1</u>
Heavy	250 ⁿ	
Light	125 ⁿ	

Reason: Many warehouse structures in Use Group S have storage rack located in them resulting in localized loading on the concrete floor slab. We wish to bring this to the attention of the registered design professional of the building when they are designing the new concrete floor slab if the actual floor loads are not known. New warehouse buildings are becoming taller and the 125 psf or 250 psf floor loads are no longer adequate when designing the concrete floor slab.

Cost Impact: The code change proposal will increase the cost of construction. While this might increase the cost of construction in warehouses slightly, it will serve to decrease the cost when evaluating existing warehouse slabs.

S60-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Proposal and wording needs to be vetted through ASCE 7. Proposal needs clarification of threshold.
(Vote: 14-0)

Assembly Action: **None**

S60-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Paul Armstrong, MHI, representing MHI (paul.armstrong@pacodeservices.com)

requests As Submitted

Commenter's Reason: The Engineering Committee of the Rack Manufacturer's Institute has submitted this Public Comment to recognize new loading that is imposed by rack structures. It is understood that ultimately this loading criteria should reside in ASCE 7 but the next edition is in 2022 and that process is only just underway. The committee commits to remove this provision in the IBC once it is published in ASCE 7. Please support this Public Comment so that such storage warehouse floor systems can be properly designed.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. However, this will decrease the cost of construction when applying this criteria in existing warehouses due to the floors being adequately designed for the new rack loads.

Public Comment# 2000

S72-19

IBC@: 1607.13.5.3, 1607.13.5.4, 1607.13.5.5

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

2018 International Building Code

Revise as follows:

~~1607.13.5.2.1~~ **1607.13.5.3 Photovoltaic panels installed on open grid roof structures.** Structures with open grid framing and without a roof deck or sheathing supporting photovoltaic panel systems shall be designed to support the uniform and concentrated roof live loads specified in Section 1607.13.5.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m²).

~~1607.13.5.3~~ **1607.13.5.4 Photovoltaic panels or modules installed as an independent structure. Ground-mounted photovoltaic (PV) panel systems.** ~~Solar photovoltaic panels or modules~~ Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic live load, ~~provided that the area under the structure is restricted to keep the public away.~~ Other loads and combinations in accordance with Section 1605 shall be accommodated. ~~Solar photovoltaic panels or modules that are designed to be the roof, span to structural supports and have accessible/occupied space underneath shall have the panels or modules and all supporting structures designed to support a roof photovoltaic live load, as defined in Section 1607.13.5.1 in combination with other applicable loads. Solar photovoltaic panels or modules in this application are not permitted to be classified as “not accessible” in accordance with Section 1607.13.5.1.~~

~~1607.13.5.4~~ **1607.13.5.5 Ballasted photovoltaic panel systems.** Roof structures that provide support for ballasted *photovoltaic panel systems* shall be designed, or analyzed, in accordance with Section 1604.4; checked in accordance with Section 1604.3.6 for deflections; and checked in accordance with Section 1611 for ponding.

Reason: In development of the 2018 IBC, new Section 1607.13.5.2.1 was created to use language similar to ASCE 7-16. As the second paragraph of Section 1607.13.5.3 was intended to state the requirements for the same type of structure, Section 1607.13.5.3 is now redundant and outdated in the 2018 IBC. This proposal strikes out the redundancy second paragraph.

The first paragraph of Section 1607.13.5.3 is intended to state the requirements for ground-mounted PV systems, so is now updated to use that term.

Sections are re-numbered for better flow, such that:

1607.13.5.2 is for rooftop-mounted PV systems

1607.13.5.3 is for overhead structures with open-grid framing (renumbered from 1607.13.5.2.1)

1607.13.5.4 is for ground-mounted PV systems (renumbered from 1607.13.5.3)

1607.13.5.5 is for ballasted rooftop PV systems (renumbered from 1607.13.5.4)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal clarifies the language, and will not increase or decrease cost of construction.

S72-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns that this change had not yet been vetted through ASCE 7.
(Vote: 12-2)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

requests As Submitted

Commenter's Reason: In development of the 2018 IBC, new Section 1607.13.5.2.1 was created to use language similar to ASCE 7-16. As the second paragraph of Section 1607.13.5.3 was intended to state the requirements for the same type of structure, Section 1607.13.5.3 is now redundant and outdated in the 2018 IBC.

This Proposal S72-19 and this Public Comment seeks to correct a mistake that exists in the 2018 IBC, by striking out the redundant second paragraph.

NOTE: Subsection 1607 is titled "Live Loads." This proposal and public comment seek to clarify live loads on PV systems, consistent with the original intent of previous Subsection 1607.12.5 of the 2015 IBC, as developed by NCSEA in collaboration with SEACOC.

The first paragraph of Section 1607.13.5.3 is intended to state the requirements for ground-mounted PV systems, so is now updated to use that term.

Sections are re-numbered for better flow, such that:

1607.13.5.2 is for rooftop-mounted PV systems

1607.13.5.3 is for overhead structures with open-grid framing (renumbered from 1607.13.5.2.1)

1607.13.5.4 is for ground-mounted PV systems (renumbered from 1607.13.5.3)

Section 1607.13.5.4 simply replaces:

"Solar photovoltaic panels or modules that are independent structures and do not have accessible/occupied space underneath ..."

with the common industry term "ground mount" accompanied by the defined term "photovoltaic panel systems":

"Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath ..."

1607.13.5.5 is for ballasted rooftop PV systems (renumbered from 1607.13.5.4, with no other changes)

When viewed as clean text, the reader should see that the proposed language will clarify the provisions applicable to overhead structures and ground-mounted systems with no occupancy beneath. These changes are editorial only, and do not change the fundamental provisions for live load for these structures.

1607.13.5.3 Photovoltaic panels installed on open grid roof structures. Structures with open grid framing and without a roof deck or sheathing supporting photovoltaic panel systems shall be designed to support the uniform and concentrated roof live loads specified in Section 1607.13.5.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m²).

1607.13.5.4 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic live load. Other loads and combinations in accordance with Section 1605 shall be accommodated.

1607.13.5.5 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604.4; checked in accordance with Section 1604.3.6 for deflections; and checked in accordance with Section 1611 for ponding.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal clarifies the language, and will not increase or decrease cost of construction.

S75-19

IBC: 1609.1.1, Chapter 35 AASHTO (New)

Proposed Change as Submitted

Proponents: Ray Minor, representing Self (ray.minor@hapco.com); Jay Baumgartner, Valmont Industries, representing Valmont Industries (jay.baumgartner@valmont.com)

2018 International Building Code

Revise as follows:

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7-7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. Luminaire support structures designed in accordance with AASHTO LTS-6. Athletic field lighting structures taller than 55' shall be designed to meet the 50 year design life wind load and the Fatigue Importance Category I Natural Wind Gust requirements of AASHTO LTS-6.

The wind speeds in Figures 1609.3(1) through 1609.3(8) are basic design wind speeds, V , and shall be converted in accordance with Section 1609.3.1 to *allowable stress design* wind speeds, V_{asd} , when the provisions of the standards referenced in Exceptions 4, 5 and 7 are used.

Add new standard(s) as follows:

AASHTO

Association of State Highway and
Transportation Officials
4444 North Capitol Street, NW Suite 249
Washington DC 20001
US

LTS-6-2013: Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

Reason: The AASHTO LTS-6 specification is based on much research and many years of experience in using primarily pole type structures to support signs, luminaires and traffic signals along roadways. These types of structures are also used for many non-roadway applications such as sports lighting and parking lot lighting which may come under the jurisdiction of the IBC. The AASHTO LTS-6 wind pressure calculations are based on ASCE 7. ASCE 7-16 C29.4 states "For the design of structural supports for highway signs, luminaires and traffic signals, see AASHTO LTS-6 (AASHTO 2013)". The AASHTO LTS-6 contains provisions for the fatigue design of structural supports for signs, luminaires and traffic signals that are exclusive to AASHTO. Several athletic field lighting structures that would not meet these fatigue requirements have failed (See Consumer Product Safety Commission link in Bibliography and Stadium Pole Failures file in Attachments). These failures most likely would not have occurred if the poles had been designed to meet the natural wind gust fatigue requirements of the AASHTO LTS-6 specification.

Bibliography: United States Consumer Product Safety Commission report "Recall to Repair: Whitco Company LP Stadium Light Poles Can Fall Over, Posing Risk of Serious Injury and Death" link:
<https://www.cpsc.gov/Recalls/2010/recall-to-repair-whitco-company-lp-stadium-light-poles-can-fall-over-posing-risk-of>

Cost Impact: The code change proposal will increase the cost of construction

The sports lighting poles that failed would not meet the transverse plate minimum thickness requirement of AASHTO LTS-6 Paragraph 5.14.3 which likely contributed to the failures. These poles would be identified as high level luminaire supports in LTS-6 Paragraph 1.4.2 which would require them to be designed for fatigue according to LTS-6 Paragraph 11.3. Fatigue design specifications of LTS-6 Section 11 generally requires heavier poles than designing for maximum wind speed alone.

Staff Analysis: A review of the standard proposed for inclusion in the code, AASHTO LTS-6-2013, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns as to the following:

1. why reference the older ASCE 7-05?
2. questioned the background for using a 50 year design life
3. format - many requirements are provided in the exceptions

(Vote: 12-2)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: 1609.1.1 (New)

Proponents:

Jay Baumgartner, representing Valmont Industries (jay.baumgartner@valmont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. Luminaire support structures designed in accordance with AASHTO LTS-6. Athletic field lighting structures taller than 55' shall be designed to meet the 50-year design life wind load and the Fatigue Importance Category I Natural Wind Gust Fatigue Importance Category I of the high-mast lighting tower fatigue requirements of AASHTO LTS-6.

The wind speeds in Figures 1609.3(1) through 1609.3(8) are basic design wind speeds, V , and shall be converted in accordance with Section 1609.3.1 to *allowable stress design* wind speeds, V_{asd} when the provisions of the standards referenced in Exceptions 4, 5 and 7 are used.

Commenter's Reason: The inclusion of the AASHTO LTS-6 Specifications will provide safer lighting structures as well as a more refined design analysis. In accordance with Section 1609.1.1, the wind speed maps from Figures 1609.3(1) through 1609.3(8) shall be used and converted in accordance with Section 1609.3.1 for use with AASHTO. In addition, the Risk Category II wind speeds (MRI = 700 Years) are generally equivalent to the basic wind speeds found in AASHTO LTS-6 (50-year return period) based upon research referenced by ASCE 7 after moving the wind load factor for the strength design approach.

Adding the AASHTO LTS-6 Specifications will also bring consistency to Section 1609.1.1, where similar non-building structures are already addressed. Section 1609.1.1 Exceptions 4 and 5 are used for the design of flagpoles (NAAMM FP 1001) and antenna-supporting structures (TIA-222), respectively. ASCE 7-16 C29.4 also states "It is not the intent of this standard to exclude the use of other recognized literature for the design of special structures ... For the design of flagpoles, see NAAMM (2007). For the design of structural supports for highway signs, luminaires, and traffic signals, see AASHTO LTS-6 (AASHTO 2013)." I therefore urge approval of this proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This proposal would likely only increase the cost of construction for those structures requiring a fatigue design.

Public Comment# 1434

S83-19

IBC: 1703.1.3.1 (New)

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, National Ready Mixed Concrete Association, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

2018 International Building Code

1703.1.3 Personnel. An *approved agency* shall employ experienced personnel educated in conducting, supervising and evaluating tests and *special inspections*.

Add new text as follows:

1703.1.3.1 Structural concrete special inspector. Individuals with current credentials demonstrating that the requirements of ACI Concrete Construction Special Inspector or ICC Reinforced Concrete Special Inspector have been satisfied shall be permitted to act as special inspectors for structural concrete construction.

Reason: This code change proposal provides the criteria for personnel to be considered qualified to conduct special inspections of structural concrete. The American Concrete Institute Committee C630 - Construction Inspector Certification has developed a rigorous program to certify individuals as qualified to perform special inspection of concrete construction. This code change proposal does not alter any existing criteria of other individuals qualified as special inspectors, but adds provisions for individuals who are ACI or ICC certified concrete construction special inspectors to be permitted to satisfy the code criteria as special inspectors for concrete construction. This proposal provides the criteria, but does not require individuals to be certified as an ACI Concrete Construction Special Inspector. The ACI requirements are provided in the attached file, cpp-6301-15.pdf, or may be found at: https://www.concrete.org/Portals/0/Files/PDF/cpp_6301-15.pdf.

Jurisdictions are adding these requirements to their codes. As a model code, this requirement should be included in the IBC to assist the jurisdictions in having the language properly incorporated into their respective codes. For example, the Georgia Building Code now includes certified inspectors. See pages 12 through 15 of the attached file, 2014-ibcamendments.pdf.

The American Concrete Institute, as a professional society whose mission includes working to facilitate the use and adoption of current concrete technology to assure the desired performance for the benefit of the public, encourages the committee to approve of this code change as submitted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change allows current practice for selection of individuals or entities to perform special inspection. The change adds qualifications for individuals to assist the building code official in approving such individuals and provides a degree of confidence that special inspections will be properly conducted.

S83-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: While the committee agreed that training of special inspectors is important, they expressed concerns that the proposal is in the wrong section of the code.

(Vote: 10-4)

Assembly Action:

None

S83-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1704.2.1.1 (New), ACI Chapter 35 (New)

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

~~1703.1.3.1~~ **1704.2.1.1 Structural concrete special inspector.** Individuals satisfying the requirements of Section 1.6 of ACI 311.7 as Concrete Special Inspector with current credentials demonstrating that the requirements of ACI Concrete Construction Special Inspector or ICC Reinforced Concrete Special Inspector have been satisfied shall be permitted to act as special inspectors for structural concrete construction.

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills MI 48331

311.7-18: Specification for Inspection of concrete Construction

Commenter's Reason: This public comment provides the criteria for personnel to be considered qualified to conduct special inspections of structural concrete. The American Concrete Institute Committee 311 has developed language that identifies individual qualified to conduct special inspection of structural concrete construction. These provisions are identified in Section 1.6 Qualifications of ACI 311.7 Inspection Services Specification for Cast-in-Place Concrete Construction. This proposal does not alter any existing criteria of other individuals qualified as special inspectors, but adds provisions for individuals certified as concrete construction special inspectors to be permitted to satisfy the code criteria as special inspectors for concrete construction. This proposal increases the pool of individuals that may be identified as qualified to conduct such inspections. These qualifications create an improved confidence that the individuals conducting inspections have had the appropriate training and demonstrated competence in conducting special inspections of structural concrete construction. During the Committee Action Hearings *the committee agreed that training of special inspectors is important, they expressed concerns that the proposal is in the wrong section of the code.* This modification relocates the provision from section 1703.3.1.3 to Section 1704.2.1 Special inspector qualifications.

Bibliography: 311.7-18: Specification for Inspection of Concrete Construction
CPP 630.1-15 Certification Policies for Concrete Construction Special Inspector

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal allows current practice for selection of individuals or entities to perform special inspection while including qualifications for additional individuals. This increases the pool of qualified individuals and is expected to decrease costs.

Public Comment# 1272

S86-19

IBC@: 1704.2

Proposed Change as Submitted

Proponents: Terry Kozlowski, representing Southern Nevada Chapter; Nenad Mirkovic, representing City of Las Vegas; Amanda Moss, representing SN-ICC Member; Cassidy Wilson, representing SN-ICC Member

2018 International Building Code

Revise as follows:

1704.2 Special inspections and tests. Where application is made to the *building official* for construction as specified in Section 105, the owner or the owner’s authorized agent, other than the contractor, shall employ one or more *approved agencies* to provide *special inspections* and tests during construction on the types of work specified in Section 1705 and identify the *approved agencies* to the *building official*. These *special inspections* and tests are in addition to the inspections by the *building official* that are identified in Section 110.

Exceptions:

1. *Special inspections* and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as *approved by the building official*.
2. Unless otherwise required by the *building official*, *special inspections* and tests are not required for detached 1 & 2 family dwellings and Group U occupancies that are accessory to a residential occupancy including occupancy accessory structures, including but not limited to, those listed in Section 312.1.
3. *Special inspections* and tests are not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.1.2 or the conventional light-frame construction provisions of Section 2308.
4. The contractor is permitted to employ the *approved agencies* where the contractor is also the owner.

Reason: Local inspectors have previously been required to inspect the shear walls and other details needed to resist lateral forces. This proposal will provide the building official with discretion in the application of special inspection requirements for residential construction and would allow the local building inspector to inspect detached 1 & 2 family dwellings and accessory structures.

Cost Impact: The code change proposal will decrease the cost of construction
This proposal will decrease the cost of construction by eliminating the requirement for special inspection.

S86-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns that the proposal should not eliminate all detached 1 and 2 family dwellings from special inspections.

(Vote: 12-1)

Assembly Action:

None

S86-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1704.2

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

Replace as follows:

2018 International Building Code

1704.2 Special inspections and tests. Where application is made to the *building official* for construction as specified in Section 105, the owner or the owner's authorized agent, other than the contractor, shall employ one or more *approved agencies* to provide *special inspections* and tests during construction on the types of work specified in Section 1705 and identify the *approved agencies* to the *building official*. These *special inspections* and tests are in addition to the inspections by the *building official* that are identified in Section 110.

Exceptions:

1. *Special inspections* and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as *approved by the building official*.
2. Unless otherwise required by the *building official*, *special inspections* and tests are not required for Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.
3. *Special inspections* and tests are not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.1.2 or the conventional light-frame construction provisions of Section 2308.
4. *Special inspections* and tests are not required for portions of one- and two-family dwellings and townhouses and their accessory structures designed in accordance with Section R301.1.3 of the *International Residential Code*.
- ~~4-5.~~ The contractor is permitted to employ the *approved agencies* where the contractor is also the owner.

Commenter's Reason: The purpose of this public comment is to replace the initial proposal with a more targeted exception for engineered portions of dwellings otherwise complying with the IRC.

Section R301.1.3 of the IRC allows for design in accordance with accepted engineering practice for portions of a detached dwelling, townhouse, or accessory structure that generally falls within the scope of the IRC but that contains structural elements which exceed an individual limit of the IRC.

Permits for such dwellings are generally issued and inspections performed under a jurisdiction's policies and procedures for residential structures. However, NAHB members have reported some building departments requiring special inspections for engineered components of a dwelling otherwise and constructed under the prescriptive structural provisions of the IRC.

Special inspections were originally conceived to address elements and systems of construction for commercial buildings that due to their unique nature or complexity needed a level of review beyond the standard building department plan review and inspections. Typical elements of a dwelling where engineering is frequently performed include tall foundation walls, structural composite lumber beams and posts, steel framing over a basement, and truss roof assemblies. Some engineers have argued these systems can be complex and require a special inspector. However, in most typical dwellings, these elements are still designed using common material strengths, standard configurations, typical connection types, and standard construction details.

Estimates obtained from the Home Innovation Research Labs suggest a minimum cost to a homeowner for a special inspection of one component (e.g. a long-span truss) is on the order of \$530. The minimum cost to a homeowner for a more extensive set of special inspections that could include the components of the wind or seismic force-resisting system could be as much as \$900. There is no need to burden homeowners with hundreds of dollars of additional costs simply because a typical size dwelling just happens to incorporate an engineered foundation wall, roof trusses, a few LVL's, or a few steel beams and posts.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

As noted in the reason statement, cost studies by Home Innovation Research Lab show a homeowner could save between \$500 and \$900 by avoiding the need for an unnecessary special inspection.

S87-19

BC: 1704.2.6 (New), ACI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, National Ready Mixed Concrete Association, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

2018 International Building Code

Add new text as follows:

1704.2.6 Concrete tests. Field and laboratory technicians qualifications shall comply with ACI 311.6.

Add new standard(s) as follows:

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills MI 48331

ACI 311.6-18: Specification for Ready Mixed Concrete Testing Services

Reason: Proper sampling, specimen preparation and acceptance testing of concrete delivered to construction projects is crucial for assuring proper performance of structural concrete. Inaccurate test results and the negative implications on the performance of concrete occur far too frequently. When field testing, preparation of samples and laboratory testing are not conducted properly there may be significant expenses and delays added to the cost of construction, such as extracting cores of hardened concrete to verify concrete strength. Improper sampling, preparation and testing often cause project delays, further increasing costs.

On many projects the qualifications for technicians are included in the construction documents. There is a need to assure cast-in-place concrete is properly sampled, prepared and tested. Cast-in-place concrete is one of the few building materials provided to the construction site in a condition other than its final state. Verification of properties should only be performed by qualified individuals.

Local jurisdictions have already begun to address this concern. In 2014 the Georgia Building Code included an amendment to the IBC which added ACI Concrete Field Testing Technician with Grade 1 certification: https://dca.ga.gov/sites/default/files/2014_ibcamendments.pdf. In 2018 the Georgia Building Code included another amendment to the IBC which added American Concrete Institute (ACI) Strength Testing Technician: https://dca.ga.gov/sites/default/files/2018_ibcamendments.pdf. This demonstrates the need to more clearly communicate the necessary qualifications for technicians conduction sampling, specimen preparation and testing of concrete.

ACI, a technical professional society, recommends that the committee approve this code change proposal as submitted to 1) improve the quality assurance processes for structural concrete, 2) reduce project cost increases due to inappropriate sampling, preparation and testing, 3) reduce the frequency of related construction delays, and 4) help assure that the concrete being used in structural elements will provide the life safety and property protection necessary to satisfy the intent of the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There is no cost increase for this code change proposals, as for most projects these requirements are included in the contract documents between the owners, designers, and contractors. This code change proposal helps to assure that these requirements are included for structural concrete.

Staff Analysis: A review of the standard proposed for inclusion in the code, ACI 311.7-18, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S87-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that the proponent did not clearly justify why the proposal is needed in the IBC. The proposal would greatly benefit from adding 'or equivalent' during the public comment phase. (Vote: 12-2)

Assembly Action:

None

S87-19

Individual Consideration Agenda

Public Comment 1:

IBC®: 1704.2.6 (New), ACI Chapter 35 (New)

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1704.2.6 Concrete tests. Unless otherwise approved, individuals conducting field tests of structural concrete shall satisfy the requirements of ACI 311.6 Section 1.2.1.1 Field technician. Unless otherwise approved, individuals conducting laboratory tests of structural concrete elements shall satisfy the requirements of ACI 311.6 section 1.2.1.2 Laboratory technician. Field and laboratory technicians qualifications shall comply with ACI 311.6.

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills MI 48331

ACI 311.6-18: Specification for Ready Mixed Concrete Testing Services

Commenter's Reason: This proposal adds criteria to the building code to help assure proper sampling, specimen preparation and acceptance testing of concrete delivered to construction projects. This is crucial for assuring proper performance of structural concrete. Inaccurate test results and the negative implications on the performance of concrete occur far too frequently and add to the cost of construction by requiring sampling and testing of cores or other verification of concrete properties. Too, there are additional costs related to delays in construction.

The language in ACI 311.6 is:

1.2.1.1 Field technician—Technicians conducting field tests of concrete shall be certified as ACI Concrete Field Testing

Technician – Grade I, unless otherwise specified.

1.2.1.2 Laboratory technician—Technicians conducting laboratory testing shall be certified as ACI Concrete Laboratory

Testing Technician – Level 1 or ACI Concrete Strength Testing Technician, unless otherwise specified.

During the Committee Action Hearings, *the committee felt that the proponent did not clearly justify why the proposal is needed in the IBC. The proposal would greatly benefit from adding 'or equivalent' during the public comment phase.* The language in the modification specifically includes “unless otherwise specified” to permit testing by any individuals approved by the building official. This language is deemed to better capture the intent of the committee than requiring an equivalent to the specific ACI requirements.

Bibliography: ACI 311.6-18: Specification for Ready Mixed Concrete Testing Services

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Testing is already required. This modifications sets criteria for technician qualifications.

Public Comment# 1273

S90-19

IBC@: 1704.6

Proposed Change as Submitted

Proponents: Gregory Robinson, representing National Council of Structural Engineers Associations (NCSEA) (grobinson@lbyd.com)

2018 International Building Code

Revise as follows:

1704.6 Structural observations. Where required by the provisions of Section 1704.6.1, 1704.6.2 or 1704.6.3, the owner or the owner's authorized agent shall employ a *registered design professional* to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details, and load paths for general conformance to the design intent as defined in the approved construction documents. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the *special inspections* in Section 1705 or other sections of this code.

Prior to the commencement of observations, the structural observer shall submit to the *building official* a written statement identifying the frequency and extent of structural observations.

At the conclusion of the work included in the permit, the structural observer shall submit to the *building official* a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

Reason: The definition of structural observations in Chapter 2 is vague and disconnected from the requirements in Chapter 17. As a result, the various roles that form a comprehensive program of tests and inspections often get confused, and application is inconsistent. Including the proposed description in Chapter 17 provides a clearer understanding of what an observer is expected to "visually" observe - systems, details, and load paths. It is also intended to help address a widespread perception of overlap between special inspections and structural observation. Special inspections are very detailed inspections of smaller components. They require certification and specialized training to perform, but they don't necessarily require an understanding of how systems are designed to function as part of the overall building.

On the other hand, structural observations are broad, general, visual overviews of a bigger picture. Broad knowledge of structural design issues and specific knowledge of their application to the project is necessary, but observations do not strictly adhere to a standard written procedure like special inspections do.

The distinct levels of oversight are complimentary, but intended to address different aspects of quality assurance.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Clarification only. No additional cost is anticipated.

S90-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: After much discussion, the committee acknowledged that the proposal was a reasonable addition to explain to all parties what constitutes a 'structural observation'.

(Vote: 9-5)

Assembly Action:

None

S90-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1704.6

Proponents:

Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Jonathan Siu, representing City of Seattle Department of Construction and Inspections (jon.siu@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1704.6 Structural observations. Where required by the provisions of Section 1704.6.1, 1704.6.2 or 1704.6.3, the owner or the owner's authorized agent shall employ a *registered design professional* to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details, and load paths for general conformance to ~~the design intent as defined in the approved construction documents.~~ Structural observation does not include or waive the responsibility for the inspections in Section 110 or the *special inspections* in Section 1705 or other sections of this code.

Prior to the commencement of observations, the structural observer shall submit to the *building official* a written statement identifying the frequency and extent of structural observations.

At the conclusion of the work included in the permit, the structural observer shall submit to the *building official* a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

Commenter's Reason:

This public comment is intended to address an issue raised by one of the members of the Structural Committee during the hearings in May.

The current proposal requires the structural observer to evaluate construction based on the design intent as defined in the *approved construction documents*. This goes further than the *structural observation* definition (see below) where conformance to the *approved construction documents* is evaluated. This PC incorporates language from the *structural observation* definition to ensure conformance with the *approved construction documents* and keeps the section aligned with the definition.

In addition, the structural observer may or may not know the "intent" of the design. While it would be ideal for the registered design professional (RDP) performing the structural observation to also be the person who designed the structure, it is not a requirement in the code. If the owner chooses to employ a different RDP, it will be difficult (and in some cases, impossible) for the structural observer to know the design intent.

[BS] STRUCTURAL OBSERVATION. The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Aligning the duties of the structural observer with the definition of *structural observation* brings clarification of their duties and limits the scope of the observation that they perform. Without the public comment, structural observers might see their duty as extending beyond the information found on the approved *construction documents* which could add cost.

Public Comment# 1426

S96-19

IBC®: TABLE 1705.3

Proposed Change as Submitted

Proponents: Jason Krohn, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org)

2018 International Building Code

Revise as follows:

**TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION**

Portions of table not shown remain unchanged.

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD ^a	IBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	1908.4
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum 5/46" welding of reinforcement for special moment frames, boundary elements of special structural walls, and coupling beams; c. <u>Inspect welded reinforcement splices; and</u> d. <u>Inspect all other welds.</u>	— X X X	X X X	AWS D1.4 ACI 318: 26.6.4 <u>13.3</u>	—

For SI: 1 inch = 25.4 mm.

- a. Where applicable, see Section 1705.12, Special inspections for seismic resistance.
- b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

Reason: This proposal seeks to reverse a substantive change made as part of an organizational change in the 2015 IBC by Code Change S148-12. The change is shown below.

**TABLE 1705.2.2
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION OTHER THAN STRUCTURAL STEEL**

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD ^a
1. Material verification of cold-formed steel deck:			
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	Applicable ASTM material standards
b. Manufacturers' certified test reports.	—	X	
2. Inspection of welding:	—	—	
a. Cold-formed steel deck			
1. Floor and roof deck welds		X	AWS D1.3
b. Reinforcing steel bars:			
1. Verification of weldability of reinforcing steel bars other than ASTM A 706.	—	X	AWS D1.4 ACI 318 Section 3.5.2
2. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	X	—	
3. Shear reinforcement.	X	—	
4. Other reinforcing steel.	=	X	
2. <u>Single-pass fillet welds, maximum 5/16"</u>		X	
3. <u>All other welds</u>	X		

For SI: 1 inch = 25.4 mm.

- a. Where applicable, see also Section 1705.11, Special inspection for seismic resistance.

The Committee's reason for approving this code change as submitted was: "This code change simplifies the special inspections for steel by

removing requirements for reinforcing bars that don't belong under steel." This reason obviously is strictly organizational.

We believe that tying the extent of special inspection of reinforcing bars (continuous or periodic) to the function of those bars (reinforcement for special moment frames, boundary elements of special structural walls, and coupling beams) is logical. Continuous special inspection can then be mandated for welds, the failure of which is liable to have serious, even catastrophic, consequences. The logic behind mandating special inspection for all welds other than those of a particular type (and even there only up to a maximum size) is, on the other hand, difficult to see. The exception provided almost never applies. Fillet welds are used only at the ends of reinforcing bars, to connect them to plates; those welds are done at the shop using an automated welding process. Otherwise, the welds used on reinforcing bars are flare bevel groove welds or full penetration butt welds. Thus the 2015 IBC change represented an unnecessary expansion of special inspection requirements that did not result in any apparent benefit.

Modifications to the items requiring inspection have been made in ACI 318-19 Section 26.13.3. ACI 318 has determined that continuous special inspection of welding of reinforcement for intermediate moment frames is unnecessary. It has also determined that continuous special inspection of shear reinforcement is necessary only for special moment frames, boundary elements of special structural walls, and coupling beams. These determinations are reflected in this submitted code change.

Cost Impact: The code change proposal will decrease the cost of construction

The cost of precast concrete construction, where welding of reinforcing bars is not uncommon, should decrease modestly through elimination of unnecessary continuous special inspection in many cases.

S96-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns that the proponent did not sufficiently justify why the change was necessary. The reason statement implies that the change is 'organizational' only; however, it has technical changes included.

(Vote: 11-2)

Assembly Action:

None

S96-19

Individual Consideration Agenda

Public Comment 1:

IBC®: TABLE 1705.3

Proponents:

Edith Smith, representing Precast/Prestressed Concrete Institute (esmith@pci.org)

requests As Submitted

Commenter's Reason: We are asking for approval of S96 as submitted.

The original proposal was written to revert the special inspection criteria back to what they were in the 2012 IBC.

The proposed change ensures continuous special inspection of reinforcing bar welding in critical locations based on the loading conditions and adds continuous special inspection for shear reinforcing. It allows periodic inspection in less critical regions and continuous special inspection can then be mandated for welds, the failure of which is liable to have serious, even catastrophic, consequences. That is the way IBC Chapter 17 requirements were from the 2000 through the 2012 IBC.

This change also provides consistency with the AWS inspection requirement at "suitable intervals" and recognizes ACI 318-19 Section 26.13.3, which requires only special moment frames, boundary elements of special structural walls, and coupling beams necessitate continuous special inspection of flexural and shear reinforcement. There is no supporting evidence that other continuous inspections are necessary.

There is no evidence that suggests the 2015 IBC change was necessary due to a life safety hazard. All the proposed changes are in line with earlier versions of the code and enhance safety through inspection of critical items.

Please note, this change was approved during the public comment of the last code cycle. Unfortunately, the approval was overturned by on-line balloting. We would request that once again; the membership approve the code change proposal as submitted.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The cost of precast concrete construction, where welding of reinforcing bars is not uncommon, should decrease modestly through elimination of unnecessary continuous special inspection in many cases.

Public Comment# 1408

S98-19

IBC@: 1705.4

Proposed Change as Submitted

Proponents: Terry Kozlowski, representing Southern Nevada Chapter; Amanda Moss, representing SN-ICC Member; Cassidy Wilson, representing SN-ICC Member

2018 International Building Code

Revise as follows:

1705.4 Masonry construction. *Special inspections* and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602.

Exception: Special inspections and tests shall not be required for:

1. Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as *Risk Category* I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.
4. Masonry fences less than or equal to 8'-0" in height, retaining walls less than or equal to 6'-0" in height and combined masonry fences and retaining walls less than or equal to 14'-0" in overall height with the fence portion less than or equal to 8'-0" in height provided that the walls are designed in accordance with Chapter 2 of TMS 402-16 with allowable stresses for masonry reduced by one-half and f'm does not exceed 1500 psi. Wall heights shall be measured from the top of footing to the top of wall.

Reason: This proposal, eliminating the need for an additional inspection, has been utilized and evaluated in Southern Nevada for several years without any adverse structural and/or safety-related issues.

Cost Impact: The code change proposal will decrease the cost of construction Regionally, this has resulted in reduced design, permitting, construction and inspection time frames and reduced construction costs.

S98-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns that the proposal, as written, would allow larger structures than currently permitted to be constructed without special inspections. The proponent did not sufficiently justify the increase. As written, the proposal would allow a fence to be on top of a wall to create a 'tall element' to be built without special inspections.

(Vote: 14-0)

Assembly Action:

None

S98-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1705.4

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

Modify as follows:

2018 International Building Code

1705.4 Masonry construction. *Special inspections* and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602.

Exception: Special inspections and tests shall not be required for:

1. Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as *Risk Category* I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.
4. Masonry fences less than or equal to 7 feet (2134 mm) ~~8'-0"~~ in height ~~from the base of the fence or-~~ retaining walls less than or equal to 4 feet (1219 mm) ~~6'-0"~~ in height ~~measured from the top of footing to the top of the wall~~ ~~and combined masonry fences and retaining walls less than or equal to 14'-0" in overall height with the fence portion less than or equal to 8'-0" in height provided that the walls are designed in accordance with Chapter 2 of TMS 402-16 with allowable stresses for masonry reduced by one-half and f'm does not exceed 1500 psi. Wall heights shall be measured from the top of footing to the top of wall.~~

Commenter's Reason: The purpose of this public comment is to revise the proposed exception to correlate with the fence and retaining wall heights for which a permit is not required under Section 105.2. If a project consisted entirely of such a fence or such a retaining wall, a special inspection would never be required since no permit would be required, and application for a permit is necessary to trigger a special inspection under Section 1704.2. It stands to reason that a special inspection should therefore not be required for such a fence or retaining wall merely because it is part of a larger project for which a permit is sought and special inspections are triggered. By aligning with the heights required to trigger a permit, the additional language on reduced masonry stresses is no longer required, because the Section 105.2 exceptions are not linked to wall materials or material strengths.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. While the public comment would cover fewer masonry fences and retaining walls than the original proposal, the net effect of the comment and the proposal would still be a reduction in the cost of construction relative to current code, as fences up to 7 feet and retaining walls up to 4 feet included as part of a larger permit submittal would otherwise trigger special inspection.

S100-19

IBC: 1705.5.3 (New), TABLE 1705.5.3 (New)

Proposed Change as Submitted

Proponents: Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

2018 International Building Code

Add new text as follows:

1705.5.3 Mass timber construction. Special inspections of Mass Timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

**TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

Type	Continuous Special Inspection	Periodic Special Inspection
<u>1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.</u>		X
<u>2. Inspect erection of mass timber construction</u>		X
<u>3. Inspection of connections where installation methods are required to meet design loads</u>		
<u>3.1. Threaded fasteners</u>		
<u>3.1.1. Verify use of proper installation equipment.</u>		X
<u>3.1.2. Verify use of pre-drilled holes where required.</u>		X
<u>3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.</u>		X
<u>3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads</u>	X	
<u>3.3. Adhesive anchors not defined in 3.2.</u>		X
<u>3.4. Bolted connections</u>		X
<u>3.5. Concealed connections</u>		X

Reason: This proposal adds special inspection provisions to Section 1705 for mass timber. This new and unique type of construction requires a level of inspection consistent with other large buildings and unique applications where milestone inspections by the jurisdictional inspectors are not rigorous enough to ensure a level of quality control or quality assurance of the construction process. The proposed special inspections are similar to what is required for other prefabricated systems such as pre-cast concrete and structural steel.

Special Inspection is the monitoring of materials, installation, fabrication, erection and placement of components and connections that require special expertise that are critical to the integrity of the building structure. The special inspectors are required to ensure compliance with the approved construction documents and referenced standards. The program allows jurisdictions to have access to highly specialized and trained inspectors. Some special inspection activities require construction activities to be continuously inspected; which would be logistically difficult for a typical building inspection program. Special inspection is a vital part of the compliance path for successful and compliant building projects constructed under the International Building Code.

The specific elements requiring special inspection are:

1. Periodic inspection of the connection of mass timber elements to wood foundation elements. These connections are critical to transfer loads from the mass timber elements to the piles, particularly for lateral loading. The connections to concrete foundations are addressed in Table 1705.3, Item #3.
2. Periodic inspection of erection of mass timber elements. Similar to pre-cast concrete (Table 1705.3, Item #10), tall wood buildings utilizing pre-fabricated elements needs to have verification that the correct elements are placed in the right location in accordance with the design drawings.
3. Inspection of specialized connections.

Connections between mass timber products that utilized threaded, bolted, or concealed connections are considered periodic in a similar manner that concrete special inspections are required in Table 1705.3. The strength of many connection designs is predicated on specific screw lengths and installation angles. Bolted connections require specific diameters, and for lag bolts, specific lengths. Concealed connectors, many of which are proprietary, must be installed correctly for structural performance. Most of these cannot be verified by the jurisdictional inspector, so special inspections are required.

Adhesive anchorage installed in horizontal or upwardly inclined positions resisting tension loads shall be continuously inspected, again similar to Table 1705.3, Item 4a. This is required because of issues with creep of the adhesives under long-term tension loading discussed in previous code change cycles. However, once again similar to the requirements for precast concrete, all other adhesive anchors need only be inspected periodically (ref. Table 1705.3, Item 4b).

If there are other unusual items not covered in the proposed table, the existing text in Section 1705.1.1 gives the building official the authority to require special inspections for those unusual items. The same section also says the building official can require special inspections where manufacturers' installation instructions prescribe requirements not contained in the code. For example, field-glued mass timber beam or panel splices, while currently rare in North America, may become more prevalent in the future. This is not an item that is covered in the proposed Table 1705.5. While the AHC-TWB is not aware of any of those types of splices that are not currently proprietary, Section 1705.1.1 would allow the building official to require special inspections for either proprietary or non-proprietary field-glued splices. Note that many design engineers will also specify

the need for special inspections for unusual conditions in their structural notes in the construction documents, or in the statement of special inspections (see Sections 1704.2.3 and 1704.3).

No changes are being proposed to address fabrication of mass timber structural elements. Mass timber structural assembled in a fabricator shop should be addressed by sections 1704.2.5 and 1704.2.5.1 of the current codes regarding fabrication

The Ad Hoc Committee for Tall Wood Buildings (AHC-TWB) was created by the ICC Board of Directors to explore the building science of tall wood buildings with the scope to investigate the feasibility of and take action on developing code changes for these buildings. Members of the AHC-TWB were appointed by the ICC Board of Directors. Since its creation in January, 2016, the AHC-TWB has held 8 open meetings and numerous Work Group conference calls. Four Work Groups were established to address over 80 issues and concerns and review over 60 code proposals for consideration by the AHC-TWB. Members of the Work Groups included AHC-TWB members and other interested parties. Related documentation and reports are posted on the AHC-TWB website at <https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/>.

Cost Impact: The code change proposal will increase the cost of construction

Since all the code proposals related to Mass Timber products are to address new types of building construction, in theory this will not increase the cost of construction, but rather provides design options not currently provided for in the code. The committee took great care to not change the requirements of the pre-existing construction types, and our changes do not increase the cost of construction using those pre-existing construction types. However, based on a typically residential or office building of typical floor plates an estimate of Special Inspection costs would range from \$1,000 to \$2,000 per floor. Another approach to the cost of special inspection is a percentage of total construction costs; for typical pre-fabricated construction elements the cost of special inspection can range between 0.15% to 0.30%, depending on labor cost and complexities of the construction in the building. These estimates are based on responses to surveys of special inspection agencies in the Seattle and Las Vegas areas.

S100-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal adds special inspection provisions to Section 1705 for mass timber consistent with the findings of the Tall Wood Ad Hoc Committee and consistent with the Group A actions. This new and unique type of construction requires a level of inspection consistent with other large buildings and unique applications where milestone inspections by the jurisdictional inspectors are not rigorous enough to ensure a level of quality control or quality assurance of the construction process. The proposed special inspections are similar to what is required for other prefabricated systems such as pre-cast concrete and structural steel.

(Vote: 13-1)

Assembly Action:

None

S100-19

Individual Consideration Agenda

Public Comment 1:

IBC@: TABLE 1705.5.3 (New)

Proponents:

Scott Campbell, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

**TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

Type	Continuous Special Inspection	Periodic Special Inspection
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		X
2. Inspect erection of mass timber construction		X
3. Inspection of connections where installation methods are required to meet design loads		
3.1. Threaded fasteners		
3.1.1. Verify use of proper installation equipment.		X
3.1.2. Verify use of pre-drilled holes where required.		X
3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.		X
3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads	X	
3.3. Adhesive anchors not defined in 3.2.		X
3.4. Bolted connections		X
3.5. Concealed connections	X	X

Commenter's Reason: This public comment is attempting to incorporate the comments from the Committee on S100 and S101, and to balance the need for additional inspections on new systems with the desire to treat all superficially similar systems equally. The proposal suggests changing the periodic special inspection requirement to continuous special inspection for concealed connections in mass timber. The specific reasons why continuous special inspections are advised for concealed connections are:

(1) The tests performed and reviewed by the Tall Wood Ad-Hoc Committee indicated that the connections are crucial for not only the structural performance of the mass timber systems, but also for achieving the desired fire resistance. While many connection types can be visually inspected after installation, those connections that are concealed cannot be evaluated post-install. The criticality of the connections and the lack of ability to review after the fact are indicators that continuous special inspection should be required.

(2) The connections currently in use are almost entirely proprietary, requiring special training for installation, and thus should require continuous special inspection until such a time as sufficient experience has been gained that code officials can be confident that the contractors know how to correctly install the connections.

(3) The main argument for having periodic special inspections is that the mass timber systems are similar to precast concrete and steel framing systems. While this argument makes sense at first glance, the fact is that precast concrete systems have been widely used for over 60 years, and steel framing for over 100. Everyone involved, from the designers to the contractors to the code officials is aware of how the systems should be constructed and what to look for during inspections. This is not true for mass timber construction where most jurisdictions do not have any mass timber buildings. Until code officials can be confident that the contractors have sufficient experience to justify relaxed inspection requirements the more stringent continuous inspection requirements should be put into place.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This comment is dealing with a new system that is not currently in the code and therefore has no cost impact on current construction practice.

Public Comment# 2004

Public Comment 2:

IBC@: 1705.5.3 (New), TABLE 1705.5.3 (New)

Proponents:

Edith Smith, representing Precast/Prestressed Concrete Institute (esmith@pci.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1705.5.3 Mass timber construction. *Special inspections* of Mass Timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

**TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

Type	Continuous Special Inspection	Periodic Special Inspection
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		X
2. Inspect erection of mass timber construction		X
3. Inspection of connections where installation methods are required to meet design loads		
3.1. Threaded fasteners		
3.1.1. Verify use of proper installation equipment.		X
3.1.2. Verify use of pre-drilled holes where required.		X
3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.		X
3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads	X	
3.3. Adhesive anchors not defined in 3.2.		X
3.4. Bolted connections		X
3.5. Concealed connections		X
4.0. <u>Connections where installation methods are required to meet the fire resistance design in 2304.10.1.</u>		<u>X</u>

Commenter's Reason: This public comment adds special inspection provisions to Table 1705.5.3 for mass timber. Buildings of mass timber over 6-stories involves new challenges in the construction of tall buildings, and contractors and inspectors have little or no experience working with these systems of wood material for tall buildings. Due to the importance of connections in the successful fire performance of mass timber systems, and the lack of long term experience for involved parties constructing these taller buildings, a level of inspection beyond that commonly required of other construction methods is warranted. This is consistent with the intent of Section 1705.1.1 where special inspections are intended for unusual design applications of materials included in the code, or where adherence to manufacturer's instructions for materials and systems are not specified in the code is required.

Requiring special inspection of these connections for fire resistance is also similar to the requirements in Section 1705.14, where sprayed fire-resistant materials must undergo special inspections and tests to document acceptance. These requirements for mass timber are similar in nature to these special inspections.

Finally, this public comment adds Section 2304.10.1 to specify how the fire resistance rating of connections for the Types IV-A, IV-B and IV-C construction is to be determined. This language is identical to the language proposed by the ICC Ad-Hoc Committee on Tall Wood Buildings in S170-19, which was recommended for approval by the Structural Committee. It is included in this public comment to show how it would relate to the reference in Table 1705.5.3 and should not be considered as a separate code proposal.

We request that the membership approve the code change S100-19 AS MODIFIED.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Code proposals for mass timber address a new types of construction in the IBC. In theory this will not increase the cost of construction instead providing design alternatives in the code. However, because of the newness of mass timber as a method of construction there will be some additional costs to provide special inspections to ensure the code is met.

S107-19

IBC: 1705.12.7, TABLE 1705.12.7 (New), 2209.3 (New), MHI Chapter 35(New)

Proposed Change as Submitted

Proponents: Paul Douglas Armstrong, PACCS, representing MHI

2018 International Building Code

Delete and substitute as follows:

~~**1705.12.7 Storage racks.** *Periodic special inspection* is required for the anchorage of storage racks that are 8 feet (2438 mm) or greater in height in structures assigned to *Seismic Design Category D, E or F.*~~

1705.12.7 Storage racks. If required by the Engineer of Record storage racks that are 8 feet in height or greater and assigned to Seismic Design Category D, E, or F shall be inspected by an inspector designated by the Engineer of Record as detailed in Table 1705.12.7 for adherence with the approved construction documents.

Add new text as follows:

**TABLE 1705.12.7
Required Inspections of Storage Rack Systems**

Type	Continuous	Periodic	Referenced	IBC
	Inspection	Inspection	Standard	Reference
Verify materials used comply with one or more of the material test reports in accordance with the <u>approved construction documents</u>	—	X	—	—
Fabricated storage rack elements	—	X	—	1704.2.5
Installation of storage rack anchorage	—	X	MH16.1 Section 7.3.2	—
If required by the Engineer of Record, a final inspection of the completed storage rack system for compliance with the Load Application and Rack Configuration documents	—	X	—	—

2209.3 Certification For Storage Structures 8 feet in height or greater to the top load level and assigned to Seismic Design Category D, E, or F, if required by the Engineer of Record, at completion of the storage rack installation, the Engineer of Record shall submit a certificate of compliance to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents and with specifications listed in this section.

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte NC 28217

MH16.1: 2012: Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks

Reason: The design of the components that go into the storage rack are based upon minimum thickness, minimum yield strength, etc. and it is imperative that these minimum properties are complied with in the fabrication of the components and included in storage rack installations. Storage rack systems can be complex and it is important that they how they are installed complies with the permitted drawings on file with the local building department, which is why they may need to be monitored.

Cost Impact: The code change proposal will increase the cost of construction
In high seismic areas budgets will need to include this required set of inspections for installations of storage rack structures.

Staff Analysis: A review of the standard proposed for inclusion in the code, MHI MH16.1: 2012, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S107-19

Public Hearing Results

Committee Action:

As Modified

**Committee Modification:
2018 International Building Code**

1705.12.7 Storage racks. If required by the Engineer of Record, storage racks that are 8 feet in height or greater and assigned to Seismic Design Category D, E, or F, shall be provided with periodic special inspection as required by inspected by an inspector designated by the Engineer of Record as detailed in Table 1705.12.7. for adherence with the approved construction documents.

TABLE 1705.12.7

Required Inspections of Storage Rack Systems

Type	Continuous	Periodic	Referenced	IBC
	Inspection	Inspection	Standard	Reference

Verify materials used comply with one or more of the material test reports in accordance with the <i>approved construction documents</i>	—	X	—	—
Fabricated storage rack elements	—	X	—	1704.2.5
Installation of storage rack anchorage	—	X	ANSI/MH16.1 Section 7.3.2	—
If required by the Engineer of Record, a <u>At final inspection of the completed storage rack system, to indicate for compliance with the Load Application and Rack Configuration approved construction documents</u>	—	X	—	—

2209.3 Certification. For ~~rack s~~Storage ~~s~~Structures that are 8 feet in height or greater to the top load level and assigned to Seismic Design Category D, E, or F, if required by the Engineer of Record, at completion of the storage rack installation, ~~the Engineer of Record shall submit a certificate of compliance shall be submitted~~ to the owner or the owner's authorized agent stating that the work was performed in accordance with ~~approved construction documents and with specifications listed in this section.~~

MHI

Material Handling Institute

8720 Red Oak Blvd. Suite 201

Charlotte

NC

28217

MH16.1: 2012-

Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks

Committee Reason: The design of the components that go into the storage rack are based upon minimum thickness, minimum yield strength, etc. and it is imperative that these minimum properties are complied with in the fabrication of the components and included in storage rack installations. Storage rack systems can be complex and it is important that they how they are installed complies with the permitted drawings on file with the local building department, which is why they may need to be monitored. The committee expressed concerns on the contractual aspects of proposed section 2209.3 for review during the public comment phase. The approved floor modifications clarified the intent of the proposal and deletes the 'addition' of the reference as the reference is already in the IBC. (Vote: 14-0)

Assembly Action:

None

S107-19

Individual Consideration Agenda

Public Comment 1:

IBC@: TABLE 1705.12.7 (New), 2209.3 (New)

Proponents:

Paul Armstrong, MHI, representing MHI (paul.armstrong@pacodeservices.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

**TABLE 1705.12.7
Required Inspections of Storage Rack Systems**

Type	Continuous Inspection	Periodic Inspection	Referenced Standard	IBC Reference
Verify materials used comply with one or more of the material test reports in accordance with the <u>approved construction documents, when required by the engineer of the rack structure.</u>	—	X	—	—
Fabricated storage rack elements	—	X	—	1704.2.5
Installation of storage rack anchorage	—	X	ANSI/MH16.1 Section 7.3.2	—
At final inspection of the completed storage rack system, to indicate compliance with the <u>approved construction documents, when required by the engineer of the rack structure.</u>	—	X	—	—

2209.3 Certification For rack storage structures that are 8 feet in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a *certificate of compliance* shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents, when required by the engineer of the rack structure.

Commenter's Reason: In addition to the original reason statement, engineers of storage racking systems have determined that there is a need for special inspection in specific situations. With this amendment, they can have the opportunity then to have special inspectors verify that the designed rack systems are erected with the intended components approved plan and that the owner of such systems can be assured that the system will operate in its intended fashion. This is not always a requirement so Table 1705.12.7, Items 1 and 4 and Section 2209.3 are available to be used at the rack system engineer's discretion.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost of a special inspection in identified cases will increase the cost of construction.

Public Comment# 2048

Public Comment 2:

IBC@: 1705.12.7, TABLE 1705.12.7 (New)

Proponents:

Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Jonathan Siu, representing City of Seattle Department of Construction and Inspections (jon.siu@seattle.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

1705.12.7 Storage racks. ~~Steel storage racks and steel cantilevered storage racks~~ Storage racks, that are 8 feet in height or greater and assigned to Seismic Design Category D, E, or F, shall be provided with *periodic special inspection* as required by Table 1705.12.7.

**TABLE 1705.12.7
Required Inspections of Storage Rack Systems**

Type	Continuous Inspection	Periodic Inspection	Referenced Standard	IBC Reference
Verify materials used comply with one or more of the material test reports in accordance with the <i>approved construction documents</i>	—	X	—	—
Fabricated storage rack elements	—	X	—	1704.2.5
Installation of storage rack anchorage	—	X	ANSI/MH 16.1Section 7.3.2	—
<i>a. Steel storage rack</i>	—	X	ANSI/MH 16.3 Section 8.5.2	—
<i>b. Steel cantilevered storage rack</i>	—	X	ANSI/MH 16.3 Section 8.5.2	—
At final inspection of the completed storage rack system, to indicate compliance with the <i>approved construction documents</i>	—	X	—	—

Commenter's Reason: The definition *steel cantilevered storage rack* was approved by the ICC Structural Committee in proposal S161-19. This public comment incorporates *steel cantilevered storage rack* special inspection requirements and references the appropriate ANSI standard. It also clarifies that there are now two defined storage rack systems and italicizes these terms.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As mentioned in the proponents original proposal, the cost of construction will increase because these storage rack systems will now be subject to special inspection. The public comment clarifies that the requirement for special inspection, and therefore the cost increase, applies to *steel cantilevered storage racks*, not just *steel storage racks*.

Public Comment# 1850

S108-19

IBC@: 1709.5, AAMA Chapter 35 (New)

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

2018 International Building Code

Revise as follows:

1709.5 Exterior window and door assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709.5.1 or 1709.5.2. For exterior windows and doors tested in accordance with Sections 1709.5.1 or 1709.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

Exception: Structural wind load design pressures for window units smaller or door assemblies other than the size tested in accordance with Section 1709.5.1 or 1709.5.2 shall be permitted to be higher different than the design value of the tested unit assembly provided such higher pressures are determined by accepted engineering analysis analysis or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709.5.2. Components of the small unit alternate size assembly shall be the same as the tested unit. Where such calculated design pressures are or labeled assembly. Where engineering analysis is used, they it shall be validated by an additional test of the window unit having the highest allowable design pressure, performed in accordance with the analysis procedures of AAMA 2502.

Add new standard(s) as follows:

AAMA

American Architectural Manufacturers
Association
1827 Waldon Office Square, Suite 550
Schaumburg IL 60173

2502--2019: Comparative Analysis Procedure for Window and Door Products

Reason: The current exception limits the use of comparative analysis to window units smaller than the size originally tested. If comparative analysis is used to provide a higher design pressure rating of the smaller unit, it must be verified by testing of the unit as well. Additional testing should not be required if accepted engineering analysis is used.

It is also appropriate to use comparative analysis to rate window units larger than the size originally tested to lower design pressures. Testing should not be required to verify this level of performance since a higher pressure level has already been determined by testing of the same components in a smaller window unit and accepted engineering analysis is used.

This proposal revises this section as appropriate to permit the use of comparative analysis for larger as well as smaller window units than those tested. The last sentence of the section is also revised to define accepted engineering analysis as that which is specified and performed in accordance with the analysis procedures of AAMA 2502, a reference standard being added by this proposal that provides a standardized comparative analysis procedure for determining the structural integrity of window and door products.

The proposal also replaces the term "unit" with the word "assembly," as the term "assemblies" is used in the title of section 1709.5 and is the appropriate terminology that is reflected in AAMA 2502.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change will not increase the cost of construction but rather it simply permits the use of comparative analysis for larger assemblies.

Staff Analysis: A review of the standard proposed for inclusion in the code, AAMA 2502-2019, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S108-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Proposal provides a convenient way to validate based on existing test results.
(Vote: 11-3)

Individual Consideration Agenda

Public Comment 1:

Proponents: CP28 Administration

Commenter's Reason: The administration of ICC Council Policy 28 (CP28) is not taking a position on this code change. This public comment is being submitted to bring a procedural requirement to the attention of the ICC voting membership. In accordance with Section 3.6.3.1.1 of ICC Council Policy 28 (partially reproduced below), the new referenced standard AAMA 2502-2019: Comparative Analysis Procedure for Window and Door Products, must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

(CP28) 3.6.3.1.1 Proposed New Standards. In order for a new standard to be considered for reference by the Code, such standard shall be submitted in at least a consensus draft form in accordance with Section 3.4. If the proposed new standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding proposed changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the standard is not completed, the code change proposal shall automatically be placed on the Public Comment Agenda with the recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing

Public Comment# 2193

S113-19

IBC: 1805.3.2

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Building Code

1805.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other *approved* materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2 . Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene ; a drainage layer of not less than 4 inches (100 mm) of free draining granular material; a drainage layer that can be shown to provide equivalent performance to not less than 4 inches (100 mm) of free draining granular material; or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane or layers shall be lapped and sealed in accordance with the ~~manufacturer's~~ manufacturer's installation instructions.

1805.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805.2.2.1 .

1805.3.3 Joints and penetrations. Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made water tight utilizing *approved* methods and materials.

Reason: Objective:

Provide more options for foundation waterproofing and dampproofing.

This code change provides additional options for foundation waterproofing and dampproofing.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This change simply adds more options. In some cases it might decrease costs.

S113-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee did not believe that this is an 'equivalent' option as it does not bridge the nonstructural cracks and it is not suitable for heavy clay soils. In general drainage is not a substitute for waterproofing.

(Vote: 13-1)

Assembly Action:

None

S113-19

Individual Consideration Agenda

Public Comment 1:

IBC®: 1805.3.2

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1805.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2 . Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene; a drainage layer of not less than 4 inches (100 mm) of ~~free draining granular material~~ clean aggregate having a void ratio of not less than 35 percent or a Size Number of 4, 5, 56, or 6 as classified by ASTM C33; a drainage layer that can be shown to provide equivalent performance to not less than 4 inches (100 mm) of ~~free draining granular material~~ clean aggregate having a void ratio of not less than 35 percent or a Size Number of 4, 5, 56, or 6 as classified by ASTM C33; or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane or layers shall be lapped and sealed in accordance with the manufacturer's installation instructions.

Commenter's Reason: Committee reason is incorrect. In general drainage is a substitute for waterproofing and recognized as such in international codes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This change does not change costs. It provides alternative means and methods of construction.

Public Comment# 1932

S114-19

IBC@: 1807.2.3

Proposed Change as Submitted

Proponents: Terry Kozlowski, representing Southern Nevada Chapter; Nenad Mirkovic, representing City of Las Vegas; Amanda Moss, representing SN-ICC Member; Cassidy Wilson, representing SN-ICC Member

2018 International Building Code

Revise as follows:

1807.2.3 Safety factor. Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605 shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 0.6 nominal wind loads, 1.0 times other *nominal loads*, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

Exception: Where earthquake loads or wind are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

Reason: The intent is to address loads that a building is likely to experience and precludes consideration of a FACTORED LOAD which applies to limit state or strength design.

The term "nominal loads" is defined in Chapter 2 as "The magnitudes of the loads specified in Chapter 16 (dead, live, soil, wind, snow, rain, flood and earthquake)". The term "service loads" as used in the definition of "dangerous" is synonymous with the definition of "nominal loads" loads as defined in the IBC Interpretation 23-10.

The International Building Code Section 1807.2.3 covers retaining walls but it does not clearly address safety factor when the freestanding wall, fence or other structures that are constructed on top of the retaining wall or are in the close proximity of the retaining wall and supported by a retaining wall that is subject to nominal loads that include wind and not earthquake load in the load combination. This provides clarification to indicate service wind load to be used in lieu of nominal load (ultimate wind load).

Bibliography: IBC Section 1602 Definitions and Notations

FACTORED LOAD. The product of a nominal load and a load factor.

NOMINAL LOADS. The magnitudes of the loads specified in this chapter (dead, live, soil, wind, snow, rain, flood and earthquake).

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal will not increase or decrease the cost of construction but rather provides clarification to indicate service wind load to be used in lieu of nominal load (ultimate wind load).

S114-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal assumes that wind loads are typically ignored or missed; however, the committee did not concur - the load combinations include wind loads.

(Vote: 13-1)

Assembly Action:

None

S114-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

requests As Submitted

Commenter's Reason: The committee disapproved the proposal with modification because the committee felt the winds loads are not ignored or missed and the load combinations include wind loads. In rebuttal however the section clearly states that the load combinations of Section 1605 shall not apply for the retaining wall stability check requirement. In addition the section is not clear how wind loads are considered in the retaining wall stability check requirement.

This IBC section requires that retaining wall designs include a stability check for sliding and overturning and that a factor of safety be applied. Additionally, the section includes an exception that addresses where earthquake loads are included the safety factor is reduced from 1.5 to 1.1 since they are considered short-term loads. For a structural engineer to properly design a retaining wall they will need to also consider wind loads. Yet this section currently is silent when it comes to wind loads or it assumes it is considered as '*other nominal loads*' in which case the wind load case will always govern the stability of the wall when considering the load cases without earthquake loads. This is a significant structural design consideration since wind loads are generated from ASCE 7 using strength design level forces, no 0.6 load reduction factor is allowed and then required to use the 1.5 factor of safety for the wall stability check. Almost all retaining walls have a wall extension above the retained earth and exposed to wind. There are many cases where the construction of a retaining wall extends above the grade of the retained earth or where fences are directly supported on the retaining wall or constructed integral with the retaining wall.

Both earthquake and wind loads are *nominal* lateral loads generated from ASCE 7 at strength design level forces. This modification clearly includes consideration of wind loads when checking the stability of a retaining wall by multiplying the wind load by 0.6 to align the ASCE 7 strength design level wind load to an allowable stress design load as the section does for the 0.7 factor applied to ASCE 7 strength design level earthquake loads. See 2018 IBC Section 1605.3.1 using allowable stress design for the factor justification, i.e., especially Equation 16-12 which has for a combination variable (0.6W or 0.7E). The 1.1 minimum factor of safety for wind loads is consistent with the long-standing geotechnical practice of considering earthquake and wind loads interchangeably as short-term lateral loads.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The code change proposal with modification will decrease the cost of retaining wall construction where wind loads govern the design since the ultimate design level wind loads will be reduced to an allowable stress design loads and the safety factor for the wall stability check is reduced consistent with earthquake loads.

Public Comment# 1547

S118-19

IBC@: 1808.8.1

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, National Ready Mixed Concrete Association, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

2018 International Building Code

Revise as follows:

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). ~~Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.~~

Reason: This code change removes an inappropriate requirement. Grout to be pumped needs to satisfy more requirements than just those required to facilitate pumping. The consistency of the concrete must also satisfy other requirements including but not limited to workability, durability and structural performance requirements. ACI 301 *Specifications for Structural Concrete* provides that: "4.2.2.2 Slump—Unless otherwise specified, select a target slump or slump flow at the point of delivery for all concrete mixtures. Selected target slump shall not exceed 9 in. Selected target slump flow shall not exceed 30 in. Concrete shall not show visible signs of segregation. The target slump or slump flow value shall be enforced for the duration of the project." Current concrete technology provides for both concrete slump and flow as applicable for concrete placement and performance.

ACI 318 *Building Code Requirements for Structural Concrete* which is a reference in the IBC references ACI 301 for concrete mix design criteria. Thus the appropriate criteria are applicable for concrete are requirements of the IBC by reference. This text should be deleted to assure the appropriate criteria for concrete slump and flow are satisfied regardless of delivery methods. ACI, a technical professional society, recommends the committee approve this code change proposal as submitted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

In general, this code change will not increase nor decrease the cost of construction except there may be cost savings due to the use of admixtures that improve pumpability of concrete while retaining the other necessary properties of the concrete.

S118-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee respected the intent of the proposal; however, as written, the proposal needs work. The committee highly encourage updating / rewording during the public comment phase.

(Vote: 9-5)

Assembly Action:

None

S118-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1808.8.1

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where concrete or grout is to be pumped, the mix design ~~including slump shall be adjusted to~~ produce a pumpable mixture.

Commenter's Reason: This provision should be struck from the IBC. The current language requires that the "mix design shall be adjusted to produce a pumpable mixture." This does not specify who has the ability to adjust the mix design, the concrete producer, the pumping contractors or the design professional. Specification of the mix design for structural concrete should be by the design professional and deviations from the mix design required for structural performance should not be permitted. This language permits the mix design specified for the project to be adjusted to produce pumpable concrete. As with all concrete the mix design should be coordinated with the producer, contractors, and design professionals, regardless of method of placement, i.e. ready mixed concrete truck chute, pump, conveyor, funnel hopper, etc. This language should be removed from the IBC. The appropriate direction to the design professional is provided in ACI 318 Building Code Requirements for Structural Concrete, Section 26.5.2.1 and specifically subsection (f):

Concrete shall be placed in accordance with (1) through (5):

- (1) At a rate to provide an adequate supply of concrete at the location of placement.
- (2) At a rate so concrete at all times has sufficient workability such that it can be consolidated by the intended methods.
- (3) Without segregation or loss of materials.
- (4) Without interruptions sufficient to permit loss of workability between successive placements that would result in cold joints.
- (5) Deposited as near to its final location as practicable to avoid segregation due to rehandling or flowing.

To avoid discrepancies between the design professional, contractors, and producers with the language in the IBC should be deleted. also the issue is addressed in ACI 318 which is referenced for concrete in the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change maintains that where concrete or grout are intended to be pumped, the concrete mix design shall be pumpable and thus there should be no increase or decrease in cost. This modification retains the concept that mix designs be as specified by the design professional and not adjusted by contractors, producers, or sub-contractors without approval of the design professional.

Public Comment# 1944

S119-19

IBC@: 1808.8.1, TABLE 1808.8.1

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

2018 International Building Code

Revise as follows:

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table ~~1808.8.1~~ 19.2.1.1 of ACI 318.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

Delete without substitution:

**TABLE 1808.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT**

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to <i>Seismic Design Category A, B or C</i>	2,500 psi
2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to <i>Seismic Design Category D, E or F</i>	2,500 psi
2b. Foundations for other structures assigned to <i>Seismic Design Category D, E or F</i>	3,000 psi
3. Precast nonprestressed driven piles	4,000 psi
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

Reason: Removes the table for compressive strength requirements for the 2018 IBC and directs the user to ACI 318 Table 19.2.1.1 Limits for f'_c . The user is already required to use information from ACI 318 for foundations. For example, Table 1808.8.2 Minimum Concrete Cover directs the user to the requirements of Section 20.6 of ACI 318. By not having information in two places will reduce confusion, avoid unintended differences and reduce the potential for errors. Rather than having criteria in two locations this change places criteria on one reference and helps assure that other applicable provisions of ACI 318 as required by 2018 IBC Chapter 19 are not overlooked. Table 1 below shows the comparison of criteria in 2018 IBC and ACI 318. It is noteworthy that, consistent with the overall methodology throughout ACI 318, the user is directed to one section for all relevant criteria. Note that Table 19.2.1.1 has all limits for specified compressive strength in one location. This improves the user-friendliness provided by ACI 318. Further with criteria in two documents that user is required to refer to both to identify potential differences which can be a cumbersome process.

TABLE 1

Comparison of IBC AND ACI 318 MIN. COMPRESSIVE STRENGTH OF CONCRETE OR GROUT

2018 IBC	ACI 318	2018 IBC	ACI 318
Foundation Element of Condition		Specified Compressive Strength f'_c	Minimum f'_c , psi
1. Foundations for structures assigned to Seismic Design Category A, B or C	1. General	2,500	2,500
2a. Foundations for two stories or less in height, assigned to Seismic Design Category D, E or F	2. Special Moment Frames		
2b. Foundations for other structures assigned to Seismic Design Category D, E or F2	2a. Special structural walls with Grade 60 or 80 reinforcement	2,500	3,000 ¹
	2b. Special Structural walls with Grade 100 reinforcement	3,000	5,000
3. Precast nonprestressed driven piles		4,000 psi	4,000
4. Socketed drilled shafts		4,000 psi	4,000
5. Micropiles		4,000 psi	4,000
6. Precast prestressed driven piles		5,000 psi	5,000

¹ The f'_c for lightweight concrete in special moment frames and special structural walls shall not exceed 5000psi. The limit is permitted to be exceeded where demonstrated by experimental evidence that members made with lightweight concrete provide strength and toughness equal to or exceeding those of comparable members made with normalweight concrete of the same strength.

² Does not include foundations for stud bearing wall construction two stories or less.

ACI, a professional technical society, recommends the deletion of the specified compressive strength criteria from the IBC to better assure that all applicable requirements of ACI 318 are properly considered for design and construction of concrete foundations. ACI encourages the committee to approve this code change as submitted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent requested Disapproval. For foundations such as micro piles and deep foundations, ACI 318-19 is not coordinated with the current IBC. (Vote: 14-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: 1808.8.1, TABLE 1808.8.1

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in shallow foundations and micropiles shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1. Concrete or grout for deep foundations shall have specified compressive strengths in accordance with Section 13.4.2.1 of ACI 318.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

TABLE 1808.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to <i>Seismic Design Category A, B or C</i>	2,500 psi
2a. <u>Shallow</u> foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to <i>Seismic Design Category D, E or F</i>	2,500 psi
2b. <u>Shallow</u> foundations for other structures assigned to <i>Seismic Design Category D, E or F</i>	3,000 psi
3. Precast nonprestressed driven piles <u>Deep foundations for structures assigned to <i>Seismic Design Category D, E, or F</i></u>	4,000 psi <u>ACI 318 18.13.5</u>
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

Commenter's Reason: This public comment reflects the intent of industry efforts to provide design and construction for deep foundations in ACI 318 through a coordinated effort involving ASCE. New provisions are now included in ACI 318-19 to address this need for coordination. The original proposal failed to retain provisions for shallow foundations, micropiles, and deep foundations in seismic design categories A, B, and C. This public comment retains the provisions for micropiles, shallow foundations, and deep foundations in seismic design categories A, B, and C in the IBC and directs the user to ACI 318 for deep foundations where more comprehensive discussion of requirements is provided.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Criteria are not altered. Criteria for deep foundations are provided in ACI 318 with more comprehensive discussion than in the 2018 edition of the IBC.

Public Comment# 1271

S120-19

IBC: 1808.8.2, 1808.8.2.1(New), TABLE 1808.8.2

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

2018 International Building Code

Revise as follows:

1808.8.2 Concrete cover. ~~The concrete cover provided for prestressed and nonprestressed reinforcement in for all concrete deep foundations shall be not less than the largest applicable value specified in Table 1808.8.2. Longitudinal bars spaced less than 1½ inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.6.1.3.4 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface. in accordance with ACI 318 Section 20.5.1.3.4 and this section.~~

Add new text as follows:

1808.8.2.1 Structural steel deep foundations. The concrete cover for structural steel cores within a steel pipe, tube or permanent casing shall not be less than 2 inches.

Delete without substitution:

**TABLE 1808.8.2
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.6 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	3 inches 2 inches In accordance with Section 20.6.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	2.5 inches In accordance with Section 20.6.1.3.3 of ACI 318
4. Cast in place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast in place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast in place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

Reason: This code change removes the requirements in IBC Section 1808.2 and Table 1808.2 on concrete cover for foundations to avoid confusion and conflicts between the IBC and ACI 318. Plus, the references are no longer correct, as concrete cover requirements for deep foundations are addressed in Section 20.5.1.3.4 and Table 20.5.1.3.4 of ACI 318. The 2018 IBC incorrectly directs the user to Section 20.6.1.3.3 of ACI 318.

The 2018 IBC advises that ACI 318 is to be followed in addition to any requirements in the IBC by the reference to Chapter 19 of the IBC:

“1808.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808.8.1 through 1808.8.6 and the provisions of Chapter 19.”

and Chapter 19 of the 2018 IBC reads:

“ 1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318...”

There is no reason to duplicate requirements of ACI 318 in the IBC.

With regard to removal of text, there are two provisions in the text of IBC Section 1808.2.

1. There are criteria for longitudinal reinforcement and bundled bars, but the requirements in the IBC refer the user to ACI 318 Section 20.6.1.3.4. This is unnecessary language due to the IBC language in Section 1808.8 and 1901.2 as shown above.

2. The IBC language provides a definition for concrete cover which is already addressed in ACI 318: “distance between the outermost surface of embedded reinforcement and the closest outer surface of the concrete.” note that concrete cover is a specified dimension. Thus, where concrete is placed inside casings or mandrels the closest outer surface of the concrete is clearly the inside of the casing or mandrel.

With regard to the criteria in Table 1808.2, the requirements are shown as a side-by-side comparison in the Table below. The requirements remain identical for all concrete cover requirements for foundations except as follows:

1. Concrete cover for precast elements exposed to seawater is permitted to be 2 inches in ACI 318 where the 2018 IBC requires 3 inches and 2-1/2 inches for precast nonprestressed and prestressed, respectively. This modification recognizes the performance of centrifugally manufacturers precast concrete piles, which were probably not a consideration when the cover provisions were introduced into the 2018 IBC. Where additional information on cover requirements as related to manufacturing process and materials the commentary of ACI 318 directs the user to ACI 543R *Guide to Design, Manufacture, and Installation of Concrete Piles*. Now that centrifugally are becoming more commonplace, the code would be remiss in not providing for the minimum requirement that reflect current practice and materials. This lowers costs by recognizing the performance of piles manufactured using zero-slump concrete.

2. Where the 2018 IBC permits cover to be a little as 2.5 inches for deep foundations not enclosed by a steel pipe, tube or permanent casing, ACI 318 finds that the ability to assure proper cover in deep foundations is more challenging than that required for shallow foundations. ACI 318 requires the minimum cover to remain the same for deep foundations as that required for shallow foundations, 3 inches.

3. ACI 318 does not differentiate the minimum concrete cover requirements between deep foundations enclosed within a steel pipe, tube or permanent casing whether there is a structural steel core. Further ACI 318 does not consider the requirements for structural steel deep foundations to be with their purview. Section 1808.2 is retained to include the provisions for these deep foundation systems.

4. Research considered by ACI Committee 318 and Subcommittee 318-0F on Foundations showed comparable performance for cover of precast elements regardless of whether manufactured at a plant or site cast.

ACI, a 501.C.3 professional society recommends approval as submitted to reflect current concrete technology and to assure appropriate minimum requirements are provided for the protection of reinforcement.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There is no significant increase in cost of construction. Cost is decreased for precast prestressed concrete piles by reducing cover and providing for acceptable performance of new technologies and materials. There may be a slight increase in costs where deep foundations are cast without casings or tubes because the cover is increased from 2-1/2 inches to 3 inches.

S120-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent requested disapproval. The committee disapproved the proposal due to a lack of coordination (example: micro piles) (Vote: 14-0)

Assembly Action:

None

S120-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1808.8.2, TABLE 1808.8.2

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

1808.8.2 Concrete cover. The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808.8.2. Longitudinal bars spaced less than 1¹/₂ inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section ~~20.6.1.3.4~~ 20.5.1.3.5 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.

**TABLE 1808.8.2
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations <u>a. Cast-in-place non-prestressed concrete members</u> <u>b. Cast-in-place prestressed concrete members</u> <u>c. Precast non-prestressed or prestressed concrete members manufactured under plant conditions</u>	In accordance with Section 20.6 of ACI 318 <u>ACI 318: 20.5.1.3.1</u> <u>ACI 318: 20.5.1.3.2</u> <u>ACI 318: 20.5.1.3.3</u>
2. Precast prestressed deep foundation elements Exposed to seawater <u>Other</u>	2.5 inches <u>In accordance with Section 20.6.1.3.3.2 of ACI 318: 20.5.1.3.4</u>
3. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches <u>ACI 318: 20.5.1.3.4</u>
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
4.5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
5.6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

Commenter's Reason: The committee recommended disapproval of the original code change. The disapproval resulted in incorrect references to section of ACI 318-19. This public comment inserts the correct references. This code change proposal aligns the IBC with the appropriate sections of ACI 318. ACI 318 Section 20.5.2.3.4 addresses deep foundations made of either cast-in-place and precast concrete and thus the separate delineation in Table of the IBC is no longer required. Further provisions in ACI 318 are more complete for foundation systems, allowing different cover for various exposures.

Table 20.5.1.3.4—Specified concrete cover for deep foundation members in ACI 318 provides that:

Concrete exposure	Deep foundation member type	Reinforcement	Specified cover, in.
Cast against and permanently in contact with ground, not enclosed by steel pipe, tube permanent casing, or stable rock socket	Cast-in-place	All	3
Enclosed by steel pipe, tube, permanent casing, or stable rock socket	Cast-in-place	All	1-1/2
Permanently in contact with ground	precast-nonprestressed	All	1-1/2
	precast-prestressed		
Exposed to sea water	Precast-non-prestressed	All	2-1/2
	Precast-prestressed	All	2

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Generally, this code change proposal will not increase or decrease cost of construction as for the most part, this change only corrects references to ACI 318. However, by referencing ACI 318, more exposure conditions are addressed, several requiring less concrete cover than required in the 2018 IBC. The IBC does not address as many exposures as ACI 318.

S123-19

IBC: 1810.2.4.1, 1810.3.2.1(New), 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.2.2, 1810.3.8, 1810.3.8.1, 1810.3.8.2, 1810.3.8.2.1, 1810.3.8.2.2, 1810.3.8.2.3, 1818.3.9.3, 1810.3.9.4, 1810.3.9.4.1, 1810.3.9.4.2, 1810.3.9.4.2.1, 1810.3.9.4.2.2

Proposed Change as Submitted

Proponents: Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

2018 International Building Code

Revise as follows:

1810.2.4.1 Seismic Design Categories D through F. For structures assigned to *Seismic Design Category* D, E or F, deep foundation elements on *Site Class* E or F sites, as determined in Section 1613.2.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section ~~1810.3.8.3.3~~, 18.13.5.10.5 in ACI 318.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with ~~Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 as required by Section 1810.3.9.4.2.2~~, Section 18.13.5.5 of ACI 318.

Add new text as follows:

1810.3.2.1 Concrete. Concrete materials shall conform to ACI 318.

Revise as follows:

~~1810.3.2.1~~ **1810.3.2.1.1 Concrete cast in steel pipe.** Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate shall be 3/4 inch (19.1 mm). Concrete to be compacted shall have a zero slump.

Delete without substitution:

~~**1810.3.2.1.1 Seismic hooks.**~~ For structures assigned to *Seismic Design Category* C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

~~**1810.3.2.1.2 ACI 318 Equation (25.7.3.3).**~~ Where this chapter requires detailing of concrete deep foundation elements in accordance with Section 18.7.5.4 of ACI 318, compliance with Equation (25.7.3.3) of ACI 318 shall not be required.

~~**1810.3.2.2 Prestressing steel.**~~ Prestressing steel shall conform to ASTM A416.

Revise as follows:

1810.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with ~~Sections 1810.3.8.1 through 1810.3.8.3~~, ACI 318.

Exception: For structures assigned to *Seismic Design Category* C, D, E or F, the minimum spiral reinforcement index required by Section 18.13.5.10.4 and 18.13.5.10.5 of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_0 . In such cases, minimum spiral reinforcement index shall be as specified in Section 13.4.5.6 of ACI 318.

Delete without substitution:

~~**1810.3.8.1 Reinforcement.**~~ Longitudinal steel shall be arranged in a symmetrical pattern and be laterally tied with steel ties or wire spiral spaced center to center as follows:

1. At not more than 1 inch (25 mm) for the first five ties or spirals at each end; then
2. At not more than 4 inches (102 mm), for the remainder of the first 2 feet (610 mm) from each end; and then
3. At not more than 6 inches (152 mm) elsewhere.

The size of ties and spirals shall be as follows:

1. For piles having a least horizontal dimension of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).

2. For piles having a least horizontal dimension of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage).

3. For piles having a least horizontal dimension of 20 inches (508 mm) and larger, wire shall not be smaller than $\frac{1}{4}$ inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

1810.3.8.2 Precast nonprestressed piles. Precast nonprestressed concrete piles shall comply with the requirements of Sections 1810.3.8.2.1 through 1810.3.8.2.3.

1810.3.8.2.1 Minimum reinforcement. Longitudinal reinforcement shall consist of not fewer than four bars with a minimum longitudinal reinforcement ratio of 0.008.

1810.3.8.2.2 Seismic reinforcement in *Seismic Design Categories C through F*. For structures assigned to *Seismic Design Category C, D, E* or *F*, precast nonprestressed piles shall be reinforced as specified in this section. The minimum longitudinal reinforcement ratio shall be 0.01 throughout the length. Transverse reinforcement shall consist of closed ties or spirals with a minimum $\frac{3}{8}$ inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of eight times the diameter of the smallest longitudinal bar or 6 inches (152 mm) within a distance of three times the least pile dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm) throughout the remainder of the pile.

1810.3.8.2.3 Additional seismic reinforcement in *Seismic Design Categories D through F*. For structures assigned to *Seismic Design Category D, E* or *F*, transverse reinforcement shall be in accordance with Section 1810.3.9.4.2.

1810.3.8.3 Precast prestressed piles. Precast prestressed concrete piles shall comply with the requirements of Sections 1810.3.8.3.1 through 1810.3.8.3.3.

1810.3.8.3.1 Effective prestress. The effective prestress in the pile shall be not less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

1810.3.8.3.2 Seismic reinforcement in *Seismic Design Category C*. For structures assigned to *Seismic Design Category C*, precast prestressed piles shall have transverse reinforcement in accordance with this section. The volumetric ratio of spiral reinforcement shall not be less than the amount required by the following formula for the upper 20 feet (6096 mm) of the pile.

$$\rho_s = 0.04(f'_c/f_{yh})[2.5 + 2.34P/(f'_c A_g)] \tag{Equation 18-5}$$

where:

A_g = Pile cross-sectional area square inches (mm²).

f'_c = Specified compressive strength of concrete, psi (MPa).

f_{yh} = Yield strength of spiral reinforcement \leq 85,000 psi (586 MPa).

P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

ρ_s = Spiral reinforcement index or volumetric ratio (vol. spiral/vol. core).

Not less than one-half the volumetric ratio required by Equation 18-5 shall be provided below the upper 20 feet (6096 mm) of the pile.

Exception: The minimum spiral reinforcement index required by Equation 18-5 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_o . In such cases, minimum spiral reinforcement index shall be as specified in Section 1810.3.8.1.

1810.3.8.3.3 Seismic reinforcement in *Seismic Design Categories D through F*. For structures assigned to *Seismic Design Category D, E* or *F*, precast prestressed piles shall have transverse reinforcement in accordance with the following:

1. Requirements in ACI 318, Chapter 18, need not apply, unless specifically referenced.
2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand or 8 inches (203 mm), whichever is smallest.
4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of each spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Section 25.5.7 of ACI 318.
5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region

shall comply with the following:

$$\rho_s = 0.06 (f'_c / f_{yh}) [2.8 + 2.34 P / (f'_c A_g)] \quad \rho_s = 0.06 (f'_c / f_{yh}) [2.8 + 2.34 P / (f'_c A_g)] \quad \text{(Equation 18-6)}$$

but not exceed:

$$\rho_s = 0.021 \quad \rho_s = 0.021 \quad \text{(Equation 18-7)}$$

where:

A_g = Pile cross-sectional area, square inches (mm²).

f'_c = Specified compressive strength of concrete, psi (MPa).

f_{yh} = Yield strength of spiral reinforcement = 85,000 psi (586 MPa).

P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

ρ_s = Volumetric ratio (vol. spiral/vol. core).

This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.

Exception: The minimum spiral reinforcement required by Equation 18-6 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_o . In such cases, minimum spiral reinforcement shall be as specified in Section 1810.3.8.1.

6. Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing, s , and perpendicular dimension, h_c , shall conform to:

$$A_{sh} = 0.3 s h_c (f'_c / f_{yh}) (A_g / A_{ch} - 1.0) [0.5 + 1.4 P / (f'_c A_g)] \quad A_{sh} = 0.3 s h_c (f'_c / f_{yh}) (A_g / A_{ch} - 1.0) [0.5 + 1.4 P / (f'_c A_g)] \quad \text{(Equation 18-8)}$$

but not less than:

$$A_{sh} = 0.3 s h_c (f'_c / f_{yh}) (A_g / A_{ch} - 1.0) [0.5 + 1.4 P / (f'_c A_g)] \quad A_{sh} = 0.12 s h_c (f'_c / f_{yh}) [0.5 + 1.4 P / (f'_c A_g)] \quad \text{(Equation 18-9)}$$

where:

f_{yh} = yield strength of transverse reinforcement $\leq 70,000$ psi (483 MPa).

h_c = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).

s = Spacing of transverse reinforcement measured along length of pile, inch (mm).

A_{sh} = Cross-sectional area of transverse reinforcement, square inches (mm²).

f'_c = Specified compressive strength of concrete, psi (MPa).

The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.

Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.

1810.3.8.3.4 Axial load limit in Seismic Design Categories C through F. For structures assigned to *Seismic Design Category C, D, E, or F*, the maximum factored axial load on precast prestressed piles subjected to a combination of seismic lateral force and axial load shall not exceed the following values:

1.0 $2f'_c A_g$ for square piles

2.0 $4f'_c A_g$ for circular or octagonal piles

Revise as follows:

1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through ~~1810.3.9.6~~, 1810.3.9.4.

Delete without substitution:

1810.3.9.1 Design cracking moment. The design cracking moment (ΦM_{cr}) for a cast-in-place deep foundation element not enclosed by a

structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3 f'_c S_m \quad \phi M_n = 3 \sqrt{f'_c} S_m \quad \text{(Equation 18-10)}$$

For Sl:

$$\phi M_n = 0.25 \sqrt{f'_c} S_m$$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa).

S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm³).

1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of Section 1605.2 exceeds the design cracking moment determined in accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

Revise as follows:

1810.3.9.3 1810.3.9.1 Placement of reinforcement. Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided that the construction method can be demonstrated to the satisfaction of the *building official*.

1810.3.9.4 1810.3.9.2 Seismic reinforcement. Where a structure is assigned to *Seismic Design Category C*, reinforcement shall be provided in accordance with Section 1810.3.9.4.1. Where a structure is assigned to *Seismic Design Category C_s, D, E_s, or F*, reinforcement shall be provided in accordance with Section 1810.3.9.4.2, 18.13.5.7 of ACI 318.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load, E , to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810.3.9.1, ACI 318 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810.2.1.
4. Closed ties or spirals where required by Section 1810.3.9.4.2, 18.3.5.7.1 of ACI 318 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of *Seismic Design Category D*, not exceeding two stories of light-frame construction.

Delete without substitution:

1810.3.9.4.1 Seismic reinforcement in *Seismic Design Category C*. For structures assigned to *Seismic Design Category C*, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals with a minimum 3/8 inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8 longitudinal bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than the manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to *Seismic Design Category D, E or F*, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through D. For *Site Class A, B, C or D* sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Section 18.7.5.4(a) of ACI 318 shall be permitted.

1810.3.9.4.2.2 Site Classes E and F. For *Site Class E or F* sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft to medium-stiff clay.

Reason: This Code change includes revisions and additions to the Code in an effort to eliminate conflicting provisions in ACI 318-14, ASCE 7-16 and IBC-2018 regarding design of deep foundations for earthquake resistant structures. Subcommittee F, Foundations, of ACI 318 has coordinated efforts with members from ASCE 7 to bring the concrete material design requirements for foundations to one location. ASCE 7 started this effort in their cycle ending in 2016. The changes to ACI 318 shown here is the continuation of that effort. A side-by-side comparison is provided, however, difficult to follow with all the changes and dissimilar format. For a more comprehensive look at the changes in ACI 318, please review the public comment version available at <https://www.concrete.org/publications/standards/upcomingstandards.aspx>
Summary of code change proposals:

- Section 1810.2.4.1 is updated to the latest version of ACI 318.

- The sections in Materials for the design and detailing of deep foundations were updated to the latest edition of ACI 318.
 - o Section 1810.3.2.1: A general reference to ACI 318 is made and the existing requirement is moved to 1810.3.2.1.1 as it is not covered in ACI 318.
 - o Section 1810.3.2.1.1: Is covered by Section 18.13.5.4 in ACI 318.
 - o Section 1810.3.2.1.2: Is covered by Section 25.7.3.3 in ACI 318.
 - o Section 1810.3.2.2: Is covered by Section 20.3 in ACI 318.

- Section 18.10.3.8, Precast Concrete pile, was adopted by ACI 318. The exception for minimum spiral reinforcement was retained from Sections 1810.3.8.3.2 and 1810.3.8.3.3 with the appropriate references to ACI 318. The requirements for 18.10.3.8 mostly went to Section 13.4.5 and 18.3.5 of ACI 318. A comparison is provided but for a full review please reference the public comment version of ACI 318.
 - o Section 1810.3.8.1→13.4.5.2 and 13.4.5.6
 - o Section 1810.3.8.2.1→13.4.5.3
 - o Section 1810.3.8.2.2→18.13.5.10.2
 - § Exception remains
 - o Section 1810.3.8.2.3→18.13.5.10.3
 - § Exception remains
 - o Section 1810.3.8.3.1→13.4.5.4 and 13.4.5.5
 - o Section 1810.3.8.3.2→18.13.5.10.4
 - o Section 1810.3.8.3.3→18.13.5.10.5
 - o Section 1810.3.8.3.4→18.13.5.10.6

- Section 18.10.3.9, Cast-in-place deep foundation, was adopted by ACI 318.
 - o Section 1810.3.9.1→13.4.4
 - o Section 1810.3.9.2→13.4.4
 - o Section 1810.3.9.3→Remains
 - o Section 1810.3.9.4→Remains, update reference
 - o Section 1810.3.9.4.1→18.13.5.7
 - § Exception→18.13.5.8
 - o Section 1810.3.9.4.2→18.13.5.7
 - § Exception→18.13.5.8
 - o Section 1810.3.9.4.2.1→18.13.5.5
 - o Section 1810.3.9.4.2.2→18.13.5.5

IBC 2018	ACI 318
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<p>1810.3.2.1.1 Seismic hooks. For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.</p>	<p>18.13.5.4 For structures assigned to SDC C, D, E, or F, hoops, spirals, and ties in deep foundation members shall be terminated with seismic hooks.</p>								
<p>1810.3.2.1.2 ACI 318 Equation (25.7.3.3). Where this chapter requires detailing of concrete deep foundation elements in accordance with Section 18.7.5.4 of ACI 318, compliance with Equation (25.7.3.3) of ACI 318 shall not be required.</p>	<p>25.7.3.3 Except for transverse reinforcement in deep foundations, the volumetric spiral reinforcement ratio ρ_s shall satisfy Eq. (25.7.3.3).</p>								
<p>1810.3.2.2 Prestressing steel. Prestressing steel shall conform to ASTM A416.</p>	<p>20.3 Prestressing strands, wires, and bars</p> <p>20.3.1 Material properties</p> <p>20.3.1.1 Except as required in 20.3.1.3 for special moment frames and special structural walls, prestressing reinforcement shall conform to (a), (b), (c), or (d):</p> <p>(a) ASTM A416 – strand</p> <p>(b) ASTM A421 – wire</p> <p>(c) ASTM A421 – low-relaxation wire including Supplementary Requirement S1, “Low-Relaxation Wire and Relaxation Testing”</p> <p>(d) ASTM A722 – high-strength bar</p>								
<p>1810.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with Sections 1810.3.8.1 through 1810.3.8.3.</p> <p>1810.3.8.1 Reinforcement. Longitudinal steel shall be arranged in a symmetrical pattern and be laterally tied with steel ties or wire spiral spaced center to center as follows:</p> <ol style="list-style-type: none"> 1. At not more than 1 inch (25 mm) for the first five ties or spirals at each end; then 2. At not more than 4 inches (102 mm), for the remainder of the first 2 feet (610 mm) from each end; and then 3. At not more than 6 inches (152 mm) elsewhere. <p>The size of ties and spirals shall be as follows:</p> <ol style="list-style-type: none"> 1. For piles having a least horizontal dimension of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage). 2. For piles having a least horizontal dimension of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage). 3. For piles having a least horizontal dimension of 20 inches (508 mm) and larger, wire shall not be smaller than 1/4 inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage). <p>1810.3.8.2 Precast nonprestressed piles. Precast</p>	<p>13.4.5 Precast concrete piles</p> <p>13.4.5.1 Precast concrete piles supporting buildings assigned to SDC A or B shall satisfy the requirements of 13.4.5.2 through 13.4.5.6.</p> <p>13.4.5.2 Longitudinal reinforcement shall be arranged in a symmetrical pattern.</p> <p>13.4.5.3 For precast nonprestressed piles, longitudinal reinforcement shall be provided according to (a) and (b):</p> <p>(a) Minimum of 4 bars</p> <p>(b) Minimum area of $0.008A_g$</p> <p>13.4.5.4 For precast prestressed piles, the effective prestress in the pile shall provide a minimum average compressive stress in the concrete in accordance with Table 13.4.5.4.</p> <p>Table 13.4.5.4 Minimum compressive stress in precast prestressed piles</p> <table border="1" data-bbox="678 1738 1153 1927"> <thead> <tr> <th>Pile length (ft)</th> <th>Minimum compressive stress (psi)</th> </tr> </thead> <tbody> <tr> <td>Pile length \leq 30</td> <td>400</td> </tr> <tr> <td>30 < Pile length \leq 50</td> <td>550</td> </tr> <tr> <td>Pile length > 50</td> <td>700</td> </tr> </tbody> </table>	Pile length (ft)	Minimum compressive stress (psi)	Pile length \leq 30	400	30 < Pile length \leq 50	550	Pile length > 50	700
Pile length (ft)	Minimum compressive stress (psi)								
Pile length \leq 30	400								
30 < Pile length \leq 50	550								
Pile length > 50	700								

nonprestressed concrete piles shall comply with the requirements of Sections 1810.3.8.2.1 through 1810.3.8.2.3.

1810.3.8.2.1 Minimum reinforcement. Longitudinal reinforcement shall consist of not fewer than four bars with a minimum longitudinal reinforcement ratio of 0.008.

...

1810.3.8.3 Precast prestressed piles. Precast prestressed concrete piles shall comply with the requirements of Sections 1810.3.8.3.1 through 1810.3.8.3.3

1810.3.8.3.1 Effective prestress. The effective prestress in the pile shall be not less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length. Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

13.4.5.5 For precast prestressed piles, the effective prestress in the pile shall be calculated based on an assumed total loss of 30,000 psi in the prestressed reinforcement.

13.4.5.6 The longitudinal reinforcement shall be enclosed by transverse reinforcement according to Table 13.4.5.6(a) and shall be spaced according to Table 13.4.5.6(b):

Table 13.4.5.6(a) Minimum transverse reinforcement size

Least horizontal pile dimension-h (in.)	Minimum wire size transverse reinforcement ^[1]
$h \leq 16$	W4, D4
$16 < h < 20$	W4.5, D5
$h \geq 20$	W5.5, D6

[1] If bars are used, minimum of #3 bar applies to all values of h

Table 13.4.4.6(b) Maximum transverse reinforcement spacing

Reinforcement location in the pile	Maximum center-to-center spacing (in.)
First five ties or spirals at each end of pile	1
24 in. from each end of pile	4
Remainder of pile	6

<p>1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through 1810.3.9.6.</p> <p>1810.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:</p> $\phi M_n = 3\sqrt{f'_c} S_m \text{ (Equation 18-10)}$ <p>For SI: $0.25\sqrt{f'_c} S_m$</p> <p>where:</p> <p>f'_c = Specified compressive strength of concrete or grout, psi (MPa).</p> <p>S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm^3).</p> <p>1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of Section 1605.2 exceeds the design cracking moment determined in accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.</p>	<p>13.4.4 Cast-in-place deep foundations</p> <p>13.4.4.1 Cast-in-place deep foundations that are subject to uplift or where M_u is greater than $0.4 M_{cr}$ shall be reinforced, unless enclosed by a structural steel pipe or tube.</p> <p>Note $f_{cr} = 7.5\sqrt{f'_c}$</p>
<p>1810.3.9.4.1 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.</p> <p>Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:</p> <ol style="list-style-type: none"> 1. One-third of the element length. 2. A distance of 10 feet (3048 mm). 3. Three times the least element dimension. 4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2. <p>Transverse reinforcement shall consist of closed ties or spirals with a minimum 3/8 inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8- longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the</p>	<p>18.13.5 Deep Foundations</p> <p>18.13.5.1 This section shall apply to the following types of deep foundations</p> <ol style="list-style-type: none"> (a) uncased cast-in-place concrete drilled or augered piles (b) metal cased concrete piles (c) concrete filled pipe piles (d) precast concrete piles <p>18.13.5.2 For structures assigned to SDC C, D, E, or F, piles, piers, or caissons resisting tension loads shall have continuous longitudinal reinforcement over their length resisting to resist design tension forces.</p> <p>18.13.5.3 For structures assigned to SDC C, D, E, or F, the minimum longitudinal and transverse reinforcement required by 18.13.5.7 through 18.13.5.10 shall be extended over the entire unsupported length for the portion of pile in air or water, or in soil that is not capable of providing adequate lateral restraint to prevent buckling throughout this length.</p> <p>18.13.5.4 For structures assigned to SDC C, D, E, or F, hoops, spirals, and ties in deep foundation members shall be terminated with seismic hooks.</p>

reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than the manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis. Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the

18.13.5.5 For structures assigned to SDC D, E, or F or located in Site Class E or F, concrete piles shall have transverse reinforcement in accordance with 18.7.5.2, 18.7.5.3, and Table 18.7.5.4(e) within seven pile diameters above and below the interfaces between strata that are hard or stiff and strata that are liquefiable or soft.

18.13.5.6 For structures assigned to SDC D, E, or F, in foundations supporting one- and two-story stud bearing wall construction, concrete piles, piers or caissons, and foundation ties are exempt from the transverse reinforcement requirements of 18.13.5.3 through 18.13.5.5.

18.13.5.7 Uncased cast-in-place drilled or augered concrete piles or piers

18.13.5.7.1 For structures assigned to SDC C, D, E, or F, reinforcement shall be provided in uncased cast-in-place drilled or augered concrete piles where required by analysis and in accordance with the requirements in Table 18.13.5.7.1.

18.13.5.7.2 Minimum longitudinal and transverse reinforcement shall be provided along minimum reinforced lengths measured from the top of the pile in accordance with Table 18.13.5.7.1.

18.13.5.7.3 Longitudinal reinforcement shall extend at least the development length in tension beyond the flexural length of the pile, which is defined in Table 18.13.5.7.1 as the distance from the bottom of the pile cap to where $0.4M_{cr} > M_u$.

18.13.5.8 Metal-cased concrete piles

18.13.5.8.1 For structures assigned to SDC C, D, E, or F, longitudinal reinforcement requirements and minimum reinforced lengths for metal-cased concrete piles shall be the same as for uncased concrete piles in 18.13.5.7

18.13.5.8.2 Metal-cased concrete piles shall have a spiral-welded metal casing of a thickness not less than 0.0747 in. (No. 14 gauge) that is adequately protected from possible deleterious action due to soil constituents, changing water levels, or other factors indicated by boring records of site conditions.

18.13.5.9 Concrete-filled pipe piles

18.13.5.9.1 For structures assigned to SDC C, D, E or F, concrete-filled pipe piles shall have longitudinal reinforcement in the top of the pile with a total area of at least $0.01A_g$ and with a minimum length within the pile equal to two times the required embedment length into the pile cap, but not less than the development length in tension of the reinforcement.

closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through D. For Site Class A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Section 18.7.5.4(a) of ACI 318 shall be permitted.

1810.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

Table 18.13.5.7.1 Minimum reinforcement for uncased cast-in-place or augered concrete piles or pier:

Minimum Reinforcement		SDC C – All Site Classes	SDC D, E, and F – Site Class A, B, C, and D	SDC D, E, and F – Site Class E and F
Minimum Longitudinal Reinforcement Ratio (minimum number of bars)		0.0025 (minimum number of bars in accordance with 10.7.3.1)	0.005 (minimum number of bars in accordance with 10.7.3.1)	0.005 (minimum number of bars in accordance with 10.7.3.1)
Minimum Reinforced Pile Length		Longest of (a) through (d): (a) 1/3 pile length (b) 10 ft. (c) 3 times the pile diameter (d) flexural length of pile - distance from bottom of pile cap to where $0.4M_{cr}$ exceeds M_u .	Longest of (a) through (d): (a) 1/2 pile length (b) 10 ft. (c) 3 times the pile diameter (d) flexural length of pile - distance from bottom of pile cap to where $0.4M_{cr}$ exceeds M_u .	Full length of pile except in accordance with [1] or [2].
Transverse Confinement Reinforcement Zone	Length of Reinforcement Zone	3 times the pile diameter from the bottom of the pile cap	3 times the pile diameter from the bottom of the pile cap.	7 times the pile diameter from the bottom of the pile cap.
	Type of Transverse Reinforcement	Closed ties or spirals with a minimum 3/8 in. diameter.	Minimum of No. 3 closed tie or 3/8 in. diameter spiral for piles ≤ 20 in. diameter. Minimum No. 4 closed tie or 1/2 in. diameter spiral for piles > 20 in. diameter.	
			In accordance with 18.7.5.2	

	Spacing and Amount of Transverse Reinforcement	Spacing shall not exceed lesser of 6 in. or 8 longitudinal bar diameters	In accordance with 18.7.5.3 and not less than one-half the requirement of Table 18.7.5.4(e)	In accordance with 18.7.5.3 and not less than the requirement of Table 18.7.5.4(e).
Transverse Reinforcement in Remainder of Reinforced Pile Length	Type of Transverse Reinforcement	Closed ties or spirals with minimum 3/8 in. diameter.	Minimum of No. 3 closed tie or 3/8 in. diameter spiral for piles ≤ 20 in. diameter. Minimum of No. 4 closed tie or 1/2 in. diameter spiral for piles > 20 in. diameter.	
	Spacing and Amount of Transverse Reinforcement	Maximum spacing of 16 longitudinal bar diameters.	In accordance with 18.7.5.2 Spacing shall not exceed the least of (a) through (c): (a) 12 longitudinal bar diameters (b) 1/2 the pile diameter (c) 12 in.	

[1] For piles sufficiently embedded in firm soil or rock, reinforcement shall be permitted to be terminated a length above the tip equal to the lesser of 5 percent of the pile length and 33 percent of the length of the pile within rock or firm soil.

[2] In lieu of providing full length minimum flexural reinforcement, the deep foundation element shall be designed to withstand maximum imposed curvatures from the earthquake ground motions and structural response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure. Minimum reinforced length shall not be less than the requirement for SDC D, E, or F; Site Class D.

<p>1810.3.8.2 Precast nonprestressed piles.</p> <p>...</p> <p>1810.3.8.2.2 Seismic reinforcement in Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, precast nonprestressed piles shall be reinforced as specified in this section. The minimum longitudinal reinforcement ratio shall be 0.01 throughout the length. Transverse reinforcement shall consist of closed ties or spirals with a minimum 3/8 inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of eight times the diameter of the smallest longitudinal bar or 6 inches (152 mm) within a distance of three times the least pile dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm) throughout the remainder of the pile.</p> <p>1810.3.8.2.3 Additional seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, transverse reinforcement shall be in accordance with Section 1810.3.9.4.2.</p> <p>...</p> <p>1810.3.8.3 Precast prestressed piles.</p> <p>...</p>	<p>18.13.5.10 Precast concrete piles</p> <p>18.13.5.10.1 For precast concrete driven piles, the length of transverse reinforcement provided shall be sufficient to account for potential variations in the elevation of pile tips.</p> <p>18.13.5.10.2 Precast nonprestressed concrete piles for structures assigned to SDC C shall satisfy (a) through (d):</p> <p>(a) Minimum longitudinal steel reinforcement ratio shall be 0.01</p> <p>(b) Longitudinal reinforcement shall be enclosed within a minimum of No. 3 closed ties or 3/8-in. diameter spirals, for up to 20-in. diameter piles, and No. 4 closed ties or 1/2-in. diameter spirals, for larger diameter piles</p> <p>(c) Spacing of transverse reinforcement within a distance of 3 times the least cross-sectional dimension of the pile from the bottom of the pile cap shall not exceed the lesser of 8 times the diameter of the smallest longitudinal bar and 6 in.</p> <p>(d) Transverse reinforcement shall be provided throughout the length of the pile at a spacing not exceeding 6 in.</p>
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1810.3.8.3.2 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, precast prestressed piles shall have transverse reinforcement in accordance with this section. The volumetric ratio of spiral reinforcement shall not be less than the amount required by the following formula for the upper 20 feet (6096 mm) of the pile.

$$\rho_s = 0.04(f_c'/f_{yh})[2.8 + 2.34P/f_c'A_g] \text{ (Equation 18-5)}$$

where:

A_g = Pile cross-sectional area square inches (mm^2).

f_c' = Specified compressive strength of concrete, psi (MPa).

f_{yh} = Yield strength of spiral reinforcement $\leq 85,000$ psi (586 MPa).

P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

ρ_s = Spiral reinforcement index or volumetric ratio (vol. spiral/vol. core).

Not less than one-half the volumetric ratio required by Equation 18-5 shall be provided below the upper 20 feet (6096 mm) of the pile.

Exception: The minimum spiral reinforcement index required by Equation 18-5 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_0 . In such cases, minimum spiral reinforcement index shall be as specified in Section 1810.3.8.1.

1810.3.8.3.3 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, precast prestressed piles shall have transverse reinforcement in accordance with the following:

1. Requirements in ACI 318, Chapter 18, need not apply, unless specifically referenced.

2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.

3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand or 8 inches (203 mm), whichever is smallest.

18.13.5.10.3 For structures assigned to SDC D, E, or F, precast nonprestressed concrete piles shall satisfy the requirements of 18.13.5.10.2 and the requirements for uncased cast-in-place or augered concrete piles in SDC D, E, or F in Table 18.13.5.7.1.

18.13.5.10.4 For structures assigned to SDC C, precast prestressed concrete piles shall satisfy (a) and (b):

(a) If the transverse reinforcement consists of spirals or circular hoops, the volumetric ratio of transverse reinforcement, ρ_s , in the upper 20 ft shall not be less than that calculated by Eq. (18.13.5.10.4a) or calculated from a more detailed analysis by Eq. (18.13.5.10.4b):

$$0.15(f_c'/f_{yt}) \text{ (18.13.5.10.4a)}$$

$$0.04(f_c'/f_{yt})[2.8 + 2.3P_U/f_c'A_g] \text{ (18.13.5.10.4b)}$$

and f_{yt} shall not be taken greater than 100,000 psi

(b) A minimum of one-half of the volumetric ratio of spiral reinforcement required by Eq. (18.13.5.10.4a) or Eq. (18.13.5.10.4b) shall be provided for the remaining length of the pile.

18.13.5.10.5 For structures assigned to SDC D, E, or F, precast prestressed concrete piles shall satisfy (a) through (e) and the ductile pile region shall be defined as the length of pile measured from the bottom of the pile cap to the point of zero curvature plus 3 times the least pile dimension, but not less than 35 ft. If the total pile length in the soil is 35 ft or less, the ductile pile region shall be taken as the entire length of the pile:

(a) In the ductile pile region, the center-to-center spacing of spirals or hoop reinforcement shall not exceed the least of 0.2 times the least pile dimension, 6 times the diameter of the longitudinal strand, and 6 in.

(b) Spiral reinforcement shall be spliced by lapping one full turn, by welding, or by the use of a mechanical splice. If spiral reinforcement is lap spliced, the ends of the spiral shall terminate in a seismic hook. Mechanical and welded splices of deformed bars shall comply with 25.5.7.

(c) If the transverse reinforcement consists of spirals, or circular hoops, the volumetric ratio of transverse reinforcement, ρ_s , in the ductile pile region shall not be less than that calculated by Eq. (18.13.5.10.5a) or calculated from a more detailed analysis by Eq. (18.13.5.10.5b), and the required volumetric ratio shall be permitted to be obtained by providing an inner and outer spiral.

$$0.2(f_c'/f_{yt}) \text{ (18.13.5.10.5a)}$$

<p>4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of each spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Section 25.5.7 of ACI 318.</p>	<p>$0.06(f_c'/f_{yt})[2.8 + 2.3P_u/f_c'A_g]$ (18.13.5.10.5b)</p> <p>and f_{yt} shall not be taken as greater than 100,000 psi</p>
<p>5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region shall comply with the following:</p>	<p>(d) Outside of the ductile pile region, spiral or hoop reinforcement shall be provided with a volumetric ratio not less than one-half of that required within the ductile pile region, and the maximum spacing shall be in accordance with Table 13.4.4.6(b).</p>
<p>$\rho_s = 0.06(f_c'/f_{yh})[2.8 + 2.34P_u/f_c'A_g]$ (Equation 18-6) but not exceed: $\rho_s = 0.021$ (Equation 18-7)</p>	<p>(e) If transverse reinforcement consists of rectangular hoops and cross-ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region shall be the greater of Eq. (18.13.5.10.5c) and Eq. (18.13.5.10.5d). The hoops and cross-ties shall be equivalent to deformed bars not less than No. 3 in size, and rectangular hoop ends shall terminate at a corner with seismic hooks.</p>
<p>where:</p>	<p>$A_{sh} = 0.3sb_c(f_c'/f_{yt})(A_g/A_{ch} - 1.0)[0.5 + 1.4P_u/(f_c'A_g)]$ (18.13.5.10.5c)</p>
<p>A_g = Pile cross-sectional area, square inches (mm²).</p>	<p>$A_{sh} = 0.12sb_c(f_c'/f_{yh}) [0.5 + 1.4P_u/(f_c'A_g)]$ (18.13.5.10.5d)</p>
<p>f_c' = Specified compressive strength of concrete, psi (MPa).</p>	<p>and f_{yt} shall not be taken as greater than 100,000 psi</p>
<p>f_{yh} = Yield strength of spiral reinforcement \leq 85,000 psi (586 MPa).</p>	<p>18.13.5.10.6 For structures assigned to SDC C, D, E, or F, the maximum factored axial load for precast prestressed piles subjected to a combination of earthquake lateral force and axial load shall not exceed the following values:</p>
<p>P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.</p>	<p>(a) $0.2 f_c'A_g$ for square piles</p>
<p>ρ_s = Volumetric ratio (vol. spiral/vol. core).</p>	<p>(b) $0.4f_c'A_g$ for circular or octagonal piles</p>
<p>This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.</p>	
<p>Exception: The minimum spiral reinforcement required by Equation 18-6 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_o. In such cases, minimum spiral reinforcement shall be as specified in Section 1810.3.8.1.</p>	
<p>6. Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing, s, and perpendicular dimension, h_c, shall conform to:</p>	
<p>$A_{sh} = 0.3sh_c(f_c'/f_{yh})(A_g/A_{ch} - 1.0)[0.5 + 1.4P_u/(f_c'A_g)]$ (Equation 18-8)</p>	
<p>but not less than:</p>	
<p>$A_{sh} = 0.12sh_c(f_c'/f_{yh}) [0.5 + 1.4P_u/(f_c'A_g)]$ (Equation 18-9)</p>	
<p>where:</p>	
<p>f_{yh} = yield strength of transverse reinforcement \leq 70,000 psi (483 MPa).</p>	
<p>h_c = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).</p>	
<p>s = Spacing of transverse reinforcement measured along length of pile, inch (mm).</p>	

<p>A_{sh} = Cross-sectional area of transverse reinforcement, square inches (mm²).</p> <p>f'_c = Specified compressive strength of concrete, psi (MPa).</p> <p>The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.</p> <p>Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.</p> <p>1810.3.8.3.4 Axial load limit in Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E, or F, the maximum factored axial load on precast prestressed piles subjected to a combination of seismic lateral force and axial load shall not exceed the following values:</p> <ol style="list-style-type: none"> 1. $0.2f'_c A_g$ for square piles 2. $0.4f'_c A_g$ for circular or octagonal piles

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost increase or decrease associated with this code change proposal with eliminates requirements addressed in ACI 318 from the IBC to avoid confusion and potential conflicts.

S123-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee expressed concerns over the uncoordinated terminology utilized in the proposal specifically the inconsistencies between ACI 318 and IBC. Some on the committee stated that they recognized that the concept of the proposal satisfied the long-term intent of moving technical requirements from the code to the appropriate standards; however, this proposal still needs modifications to satisfy the inconsistencies. (Vote: 8-6)

Assembly Action: **None**

S123-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1810.2.4.1, 1810.3.9

Proponents:
Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1810.2.4.1 Seismic Design Categories D through F. For structures assigned to *Seismic Design Category* D, E or F, deep foundation elements on *Site Class* E or F sites, as determined in Section ~~1810.2.2~~ 18.13.5.10.5 in ACI 318 shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section 18.13.5.10.5 in ACI 318.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Section 18.13.5.5 of ACI 318.

1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through ~~1810.3.9.4~~ 1810.3.9.2 and ACI 318 Section 18.13.

Commenter's Reason: This modification includes revisions and additions to the Code in an effort to eliminate conflicting provisions in ACI 318-19, ASCE 7-16 and IBC-2018 regarding design of deep foundations for earthquake resistant structures. Subcommittee F, Foundations, of ACI 318 has coordinated efforts with members from ASCE 7 to bring the concrete material design requirements for foundations to one location. ASCE 7 started this effort in their cycle ending in 2016. The changes to ACI 318 shown here is the continuation of that effort. A side-by-side comparison was provided with the original code change proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost increase or decrease associated with this code change proposal which eliminates requirements addressed in ACI 318 from the IBC to avoid confusion and potential conflicts.

Public Comment# 1280

Public Comment 2:

Proponents:

Thomas Schaeffer, Structural Design Group, representing Self (toms@sdg-structure.com)

requests As Submitted

Commenter's Reason: As I viewed the hearing from the ICC website, I was disappointed to see that S123-19 did not pass. And as someone who worked on the foundation provisions in ACI 318-19 for the last 5 years I would like share my knowledge of this proposal and hopefully clear up some of the misconceptions I heard stated during the hearing. This process was a large undertaking by ACI 318 to assemble and organize all of the concrete deep foundation provisions from ASCE, IBC, and ACI in one Code and it is understandable that all of the aspects of the proposal S123-19 could not be adequately discussed in only a couple of minutes. Also, because S123-19 covers so much material and not just one or two provisions it was apparent that a lot of the subjects presented by the people in opposition were not accurate because they had only looked at bits and pieces and not studied S123-19 as a whole. As an engineer who has been designing structures for almost 40 years, I think it will be a great improvement if all of the provisions related to the design of concrete foundations can be located in one Code. In this Public Discussion Comment I will do my best to address each of the negatives presented by the opposition at the hearing that led to the motion to disapprove, and hopefully you will reconsider that motion and approve S123-19 as originally submitted.

I was chairman of the ACI 318 subcommittee on foundations that was responsible for writing the foundation change proposals that the full 318 committee voted on and adopted into ACI 318-19. The subcommittee was formed because of a study that had been performed outside of ACI showing the inconsistencies that occurred in the current provisions for deep foundations in seismic areas between ASCE-7, IBC, and ACI 318. The task of the subcommittee was to assemble the provisions for the concrete deep foundations all in one place, and that would be ACI 318. Many of the provisions in the IBC originated from the previous model codes and are based on ATC 3-06 and NEHRP, and they have essentially remained unchanged for some time. The goal of the ACI subcommittee was not to develop new provisions, but to organize the provisions from the three documents and assemble them in one Code document. If the concrete foundation provisions can reside in ACI 318 they will be evaluated each code cycle by the members of ACI 318 Building Code Committee and updated or revised as necessary. The 318 committee consists of professional engineers, professors, contractors, and building officials, all proficient in the knowledge of concrete design and construction. The foundation subcommittee for this code cycle included practicing engineers, some of whom that also serve on other ACI technical committees that deal specifically with foundations; 336 – Footings, Mats, and Drilled Piers and 543 – Concrete Piles. We held subcommittee meetings twice a year at the ACI Conventions and the meetings were open to the public. It is true as stated in the hearing that no pile foundation contractor associations were formally contacted, however, Dale Biggers, who is a member of the Pile Driver Contractor Association and stated in the hearing that ACI did not contact them regarding the ACI foundation work, actually attended 5 of the ACI 318-F subcommittee meetings. The ACI foundation subcommittee

also worked closely with a number of PCI members and researchers to update the recommended practice for the design of precast piling and include it in 318-19. In addition, ACI 318 has a Public Discussion period where all submitted public comments are considered and voted on by the committee. In fact, one of the opposition speakers made several public comments on the 318-19 provisions, all of which were considered and some were incorporated into 318-19. Therefore, the deep foundation provisions that are now included in ACI 318 have been fully vetted and successfully completed the consensus process.

The deep foundation provisions in 318-19 are essentially exactly the same as the related provisions that are currently in ASCE-7 and IBC. There are only very minor revisions where provisions needed to be updated. Opposition testimony stated that we are substituting a Code that works with one that is unproven, however, that can't be true because the related provisions in 318 are taken directly from ASCE 7 and the IBC.

There was discussion about the omission of SDC A and B in 318-19. In 1.4.7 of 318-19 it states the applicability of the Code, and that it includes Precast Piles in SDC A through F and Cast-in-place Concrete Piles in SDC C through F. The reason that SDC A and B for cast-in-place piles is not explicitly included is that it is not currently explicitly included in the IBC. In Section 1810.3.9 – Cast-in-place deep foundations, there is no provision that includes a statement for SDC A and B. It can be assumed that IBC Sections 1810.3.9.1 and 1810.3.9.2 include all of the Seismic Design Categories, and these two IBC provisions also appear in ACI 318-19 in Section 13.4.4, so a similar assumption can be made in ACI 318 that all SDC's are included. The remainder of the sections in IBC 1810.3.9 refer only to SDC C through F. The opposition testimony also stated that 1810.3.9.1 and 1810.3.9.2 are not included in ACI 318 and therefore must remain in the IBC, however this is incorrect, as stated above these provisions appear in 13.4.4 of ACI 318-19.

There was opposition testimony that ACI 318-19 mixes terminology for deep foundation members and the definitions are not consistent with IBC, which is not correct. The definitions in 318 are almost verbatim the definitions in IBC, except for the fact that “drilled shaft” in IBC is referred to as “drilled pier” in 318, and drilled pier is consistent with ASCE-7.

There was opposition testimony that stated that ACI 318-19 does not have provisions for reinforcement below the 1/3 pile length for a cast-in-place pile or pier in SDC. This is not correct, and the provisions for this pile or pier in ACI 318-19 [18.13.5.7] are exactly the same requirements as in IBC 1810.3.9.4.1. In addition, ACI 318 states that the longitudinal reinforcement shall extend at least the development length in tension beyond the flexural length of the pile, which is defined in ACI 318-19 [18.13.5.7].

Another statement made in opposition was that ACI 318-19 deviates from IBC with respect to provisions for piles/piers with casing. The provisions for cast-in-place concrete piles with spiral welded casing are the same in both IBC and 318. However, it should be noted that a pile with this type of casing is a mandrel driven pile that is unique and is typically known as a Raymond Pile, and since this unique type of pile is not used anymore, it should be considered to be removed from both Codes. With regards to concrete filled pipe piles or cast-in-place concrete piles with permanent casing, IBC Table 1810.3.2.6 contains allowable stress limitations for steel pipes and tubes in tension or compression. In this Table, the term “permanent casing” does not appear, but it can be assumed that permanent casing could be included as a steel pipe or tube. There was a statement made at the hearing that ACI 318-19 does not account for the presence of casing and that was a “hole” in the ACI provisions, but that is not correct. It is correct that for the maximum allowable compressive strength for deep foundation members ACI 318-19 Table 13.4.2.1 has a footnote that states that As in the equations does not include the steel in the casing, pipe, or tube; however, the commentary states that “Provisions for members designed to be composite with steel pipe or casing are covered in AISC 360”. And this statement in the 318-19 Commentary is perfectly consistent with IBC 2205.1 that states “The design, fabrication and erection of structural steel elements in buildings, structures and portions thereof shall be in accordance with AISC 360”. Therefore, ACI 318-19 and IBC are consistent with regards to provisions for the design of cast-in-place concrete piles in steel casing, pipe, or tube. However, this could be noted as a conflict in IBC in that 2205.1 states that steel design shall be in accordance with AISC 360 and that is not consistent with the allowable stresses given for structural steel elements in IBC Table 1810.3.2.6.

Therefore, based on the above discussion of the subjects presented by the opposition at the hearing I respectfully ask that S123-19 be reconsidered for adoption.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction S123-19, which is basically the incorporation of the deep foundation provisions from ASCE-7 and IBC into ACI 318-19, will not effectively increase or decrease the cost of construction.

Public Comment# 1134

S132-19

IBC@: 1810.3.5.3.1, 1810.3.11.2

Proposed Change as Submitted

Proponents: Jon-Paul Cardin, American Iron and Steel Institute, representing American Institute of Steel Construction (JCardin@steel.org)

2018 International Building Code

Revise as follows:

1810.3.5.3.1 Structural steel H-piles. Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $\frac{3}{8}$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E, or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

1810.3.11.2 Seismic Design Categories D through F. For structures assigned to *Seismic Design Category* D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
 - 1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element. .
 - 1.2. The nominal tensile strength of a steel element. .
 - 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.

3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E, or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exception: Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7 Section 12.4.3 or 12.14.3.2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force.

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

Reason: The purpose of this proposal is to correct an oversight and bring in modifications from ASCE 7-16, Section 14.1.8 to IBC Chapter 18. Interestingly, the language has been part of ASCE 7 since the 2005 edition, but not been brought forward to the IBC previously. Since ASCE 7 Chapter 14 is not typically adopted in the IBC for steel, it is necessary to add the language directly.

ASCE 7-16 Commentary states: "Steel piles used in higher SDCs are expected to yield just under the pile cap or foundation because of combined bending and axial load. Design and detailing requirements of AISC 341 for H-piles are intended to produce stable plastic hinge formation in the piles. Because piles can be subjected to tension caused by overturning moment, mechanical means to transfer such tension must be designed for the required tension force, but not less than 10% of the pile compression capacity."

Bibliography: AISC (2016), *Seismic Provisions for Structural Steel Buildings*, ANSI/AISC 341-16, American Institute of Steel Construction, Chicago, IL.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal is not intended to make technical changes to the design or construction of H-piles. It is simply intended to clarify the currently accepted practice.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASCE 4-16, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S132-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

2018 International Building Code

1810.3.11.2 Seismic Design Categories D through F.

For structures assigned to *Seismic Design Category* D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
 - 1.1 The nominal tensile strength of the longitudinal reinforcement in a concrete element.
 - 1.2 The nominal tensile strength of a steel element.
 - 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.

3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E, or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exception- Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7 Section 12.4.3 or 12.14.3.2.

2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force.

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

Committee Reason: Corrects a current code oversight by specifically allowing H-piles in the IBC for high seismic. The modification clarified the exceptions. (Vote: 13-0-1 abstaining)

Assembly Action:

None

S132-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1810.3.11.2

Proponents:

Daniel Stevenson, representing GeoCoalition (dstevenson@berkelapg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1810.3.11.2 Seismic Design Categories D through F. For structures assigned to *Seismic Design Category* D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. For piles required to resist uplift forces or provide rotational restraint, A anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
 - 1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element. .
 - 1.2. The nominal tensile strength of a steel element. .
 - 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.
3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E, or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7 Section 12.4.3 or 12.14.3.2.
2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force.

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

Commenter's Reason: The existing code language is confusing and can appear contradictory. The requirements of "...not less than 25 percent of the strength of the element in tension.", and then later "The nominal tensile strength..." can appear contradictory of one does not realize that the more restrictive requirement is only required for piles required to resist uplift forces. The added phrase clarifies that the intent of the code is that the more restrictive requirements apply only to piles required to resist uplift forces or provide rotational restraint.

The added phrase is taken verbatim from ASCE-7 section 12.13.6.5, upon which this code section is based. ASCE-7 12.13.6 contains the sentence "For piles required to resist uplift forces or provide rotational restraint, anchorage into the pile cap shall comply with the following:" Following this sentence, ASCE-7 12.13.6.5 contains the same requirements as IBC 1810.3.11.2. Adding the phrase from ASCE-7 into the code will provide consistency between the code and referenced standard ASCE-7.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This only clarifies existing code requirements.

S133-19

IBC: 1810.3.6

Proposed Change as Submitted

Proponents: Dale Biggers, P.E. GeoCoalition, representing GeoCoalition (dbiggers@bohbro.com); Daniel Stevenson, P.E., representing GeoCoalition (dstevenson@berkelapg.com); Lori Simpson, P.E., G.E., representing GeoCoalition (lsimpson@langan.com)

2018 International Building Code

Revise as follows:

1810.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Exception: Splices conforming to generally accepted engineering practices where approved by the *building official*.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

Reason: 1. Section 1810.3.6 already requires that splices "...shall be designed to resist the axial and shear forces and moments occurring at the location of the splice...". Conformance with this requirement already ensures the structural integrity of the splice. Section 1810.3.6.1 contains more restrictive splice requirements for structures assigned to seismic design categories C through F.

2. The current specification precludes commonly available splices that would be acceptable in many design situations, such as a splice located at significant depth. (i.e., where significant tension or bending demands are not expected or possible. Load requirements at the splice diminish due to soil resistance above the splice as the splice is located deeper.).

3. The depth of the splice is known when you are driving to a predefined depth. For example where 240-ft long friction piles are driven to a predefined depth, the splice between two 120-ft sections will be 120-ft below grade.

4. The current code causes unnecessary costs.

Example a.) To make a welded splice on a 20-inch diameter pipe pile costs \$ 1,015 in labor and equipment. To buy a drive-fit pipe-to-pipe splicer costs \$ 495. For 211 piles at \$520 extra, the added cost was \$ 109,720.

Example b.) A tension splice for a 14-inch square prestressed concrete pile costs \$ 553 to purchase. A drive-fit splice for that pile costs \$ 201. For 2,420 piles at \$ 352 extra, the added cost was \$ 851,000.

These are real costs on real jobs, not hypothetical examples.

5. Drive-fit splices were used successfully on the New Orleans Superdome, 52-story Shell Square, 50-story Sheraton Hotel, and many other New Orleans structures. These buildings are more than 40 years old.

6. "Supporting data" may include a geotechnical investigation and/or a load test; this requirement is similar to Section 1810.3.2.8.

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Cost Impact: The code change proposal will decrease the cost of construction

The proposed change will decrease the cost of construction but only in some areas of the country.

S133-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
2018 International Building Code

1810.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Exception: Splices conforming to generally accepted engineering practices ~~and~~ where approved by the *building official* for buildings assigned to Seismic Design Category A or B.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

Committee Reason: This proposal recognizes the condition with lower stresses to engineer the splice. The modifications clarified that the exception is only for SDC A or B and deleted the word 'and' in the exception. (Vote: 14-0)

Assembly Action:

None

S133-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1810.3.6 (New)

Proponents:

Dale Biggers, representing GeoCoalition (dbiggers@bohbro.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1810.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

~~**Exception:** Splices conforming to generally accepted engineering practices where approved by the *building official* for buildings assigned to Seismic Design Category A or B.~~

Exception: For buildings assigned to Seismic Design Category A or B, splices need not comply with the 50 percent tension and bending strength requirements where justified by supporting data.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

Commenter's Reason: After the Committee Action Hearing, we received a comment that the Exception, as originally written and approved by the Committee, was overly broad. As previously written, it could be interpreted to mean that splices would not have to be designed for the forces at the splice location during driving or at the final splice location nor would the steel core requirements apply if approved by the building official. The

intent was only to exempt splices in low seismic design categories from having to be designed to the 50 percent of the tension and bending strength of the pile material. All other requirements of this section should still apply.

The Committee approved the intent of the original proposal and this current change reflects the original intent.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The proposed change will decrease the cost of construction in some areas. Additionally, the change is intended to eliminate any misinterpretations of the intent of the code.

Public Comment# 1268

S138-19

IBC®: 1810.4.1.3

Proposed Change as Submitted

Proponents: Daniel Stevenson, P.E., representing GeoCoalition (dstevenson@berkelapp.com); Dale Biggers, P.E. GeoCoalition, representing GeoCoalition (dbiggers@bohbro.com); Lori Simpson, P.E., G.E., representing GeoCoalition (lsimpson@langan.com)

2018 International Building Code

Revise as follows:

1810.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless *approved by the building official*. ~~During driving near uncased concrete, if the concrete surface in any completed element rises or drops significantly or bleeds additional water, the previously completed element shall be replaced.~~ Driven uncased deep foundation elements shall not be installed in soils that could cause heave.

Reason: 1. Minor rises or drops are normal due to consolidation of the concrete, etc. Only significant changes in elevation are of concern.
2. There are other possible areas of concern in addition to a change of elevation of the top surface of a previously completed element. It is common to get some minimal bleed water due to concrete consolidation, but if there is excessive bleed water due to installation of another nearby pile then there is likely a problem.

3. In locations of high water table, installing piles can force ground water into previously installed piles.

4. The change clarifies the current guidelines and calls attention to conditions that should already be under consideration.

5. The proposal also clarifies that the previously completed element is the one to be replaced.

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Cost Impact: The code change proposal will not increase or decrease the cost of construction
These requirements are current industry standard quality control practice.

It will decrease costs in some cases since it may allow higher design loads where the geotechnical capacity is sufficiently higher than the structural strength.

S138-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The committee agreed that the proposal clarifies the guidelines concerning 'what needs to be replaced'. The committee expressed concerns that re-wording maybe required during the public comment phase to clarify 'which previously completed elements' and 'who makes the call'. (Vote: 13-1)

Assembly Action:

None

S138-19

Individual Consideration Agenda

Public Comment 1:

IBC®: 1810.4.1.3

Proponents:

Daniel Stevenson, representing GeoCoalition (dstevenson@berkelapp.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1810.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless *approved* by the *building official*. ~~During~~ If driving near uncased concrete ~~elements~~, ~~causes~~ if the concrete surface in any completed element ~~to rise~~ or ~~drops~~ significantly or bleeds additional water, the ~~previously~~ completed element shall be replaced. Driven uncased deep foundation elements shall not be installed in soils that could cause heave.

Commenter's Reason: The proposed modifications do not change the requirements of the code section. They clarify this code section by using more concise language.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This will clarify the code, but not change the code requirements.

Public Comment# 1928

S140-19

IBC@: 1810.4.5

Proposed Change as Submitted

Proponents: Dale Biggers, P.E. GeoCoalition, representing GeoCoalition (dbiggers@bohbro.com); Daniel Stevenson, P.E., representing GeoCoalition (dstevenson@berkelapg.com); Lori Simpson, representing GeoCoalition (lsimpson@langan.com)

2018 International Building Code

Revise as follows:

1810.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other *approved* means that ensure element capacities equal or exceed those of the test elements.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.
2. The pile is to be used only for lateral resistance.

Reason: 1. Axial load tests are only needed when there are axial loads and the capacity is in doubt.

2. This proposal adds the exception for "the pile installation is completed by driving with an impact hammer..." because piles that are started using a vibratory hammer but completed using an impact hammer should be treated as piles that are installed by an impact hammer.

3. An impact hammer can be used to assure that you have achieved or exceeded the minimum required axial capacity. Section 1810.3.3.1.1. details how capacity might be determined from impact driving.

4. The exception for " the pile is to be used only for lateral resistance" is needed because a load test for axial capacity (as implied by 1810.3.3.1.2) is not needed for piles used only for lateral resistance. Lateral load capacity requirements are covered in Section 1810.3.3.2.

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Cost Impact: The code change proposal will decrease the cost of construction

Will not increase the cost of construction. In fact, it will likely decrease cost as an axial load test will not be required where piles are used only for lateral resistance or where the pile installation is completed using an impact hammer.

S140-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The committee felt the new exceptions are appropriate and added clarification.

(Vote: 14-0)

Assembly Action:

None

S140-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1810.4.5

Proponents:

Dale Biggers, representing GeoCoalition (dbiggers@bohbro.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1810.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. ~~The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.~~

Exceptions:

1. Load testing is not required where ~~the~~ pile installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.
2. Load testing is not required where ~~the~~ vertical pile is to be used only for lateral resistance

The installation of production elements shall be controlled according to power consumption, rate of penetration or other *approved* means that ensure element capacities equal or exceed those of the test elements.

Commenter's Reason: This change is made to improve the Exceptions by making full sentences. This also narrows the scope of the Exceptions. There is no change to the original intent of the Exceptions.

The last sentence of the code has been moved unchanged to a location following the Exception to clarify that the installation still must be controlled.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This can save costs in some instances where a load test will not be required. An axial load test will not be required where piles are used only for lateral resistance or where the pile installation is completed using an impact hammer.

Public Comment# 1258

Public Comment 2:

IBC®: 1810.4.5

Proponents:

Daniel Stevenson, representing GeoCoalition (dstevenson@berkelapg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1810.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. ~~The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.~~

Exceptions:

1. Load testing is not required when ~~the~~ pile element installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.
2. Load testing is not required when a vertical element ~~The pile~~ is to be used only for lateral resistance.

The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

Commenter's Reason: The second sentence has been moved to after the exceptions to clarify that the exceptions do not apply to the requirements contained in the second sentence.

The phrase "Load testing is not required when..." has been added to both exceptions to clarify that the exceptions only apply to the load test requirement, and to make both exceptions complete sentence.

The word "pile" has been replaced with the word "element" to be consistent with the terminology used throughout the code, including this code section.

The word "vertical" has been added to the second exception to clarify that the exception will not apply to a battered element that resists lateral load from the horizontal component of its axial load.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The cost savings are less by not requiring unnecessary tests.

Public Comment# 1641

S144-19

IBC: 1901.2, SECTION 1907, 1907.1, 1907.2, 1907.3

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, representing National Ready Mixed Concrete Association (scampbell@nrmca.org)

2018 International Building Code

Revise as follows:

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. ~~Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.~~ Precast concrete diaphragms in buildings assigned to *Seismic Design Category* C, D, E or F shall be designed in accordance with the requirements of ASCE 7, Section 14.2.4.

SECTION 1907 MINIMUM SLAB PROVISIONS SLABS-ON-GROUND

1907.1 General. Slabs-on-ground not transmitting vertical loads or lateral forces from other parts of the structure to the soil shall be designed and constructed in accordance with section 1904 and this section. ~~The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.~~

Exceptions: ~~A vapor retarder is not required:~~

- ~~1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.~~
- ~~2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.~~
- ~~3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.~~
- ~~4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.~~
- ~~5. Where approved based on local site conditions.~~

Add new text as follows:

1907.1.1 Slabs-on-ground transmitting loads. Where slabs-on-ground transmit vertical loads or lateral forces from other parts of the structure to the soil all provisions in this Chapter shall be applicable.

1907.2 Thickness. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm).

1907.3 Vapor retarder. A polyethylene vapor retarder having a minimum 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder thickness and with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exceptions: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where approved based on local site conditions.

Reason: Reason: The current language is not clear. First the provisions are only applicable to slabs on ground and this should be more clearly stated. Further it is generally understood that all provisions of the IBC are minimum requirements. This code change places all provisions uniquely applicable to slabs-on-ground in one section rather than having provisions in sections 1901.2 and 1907.

Modifications shown as new section 1907.1.1. This portion of the proposed revision is editorial, deleting slab-on-ground provisions from Section 1901.2 (shown above as deleted text) and moving the provisions to the more appropriate section, 1907. This places provisions for concrete slabs-on-ground in one section.

Modifications shown as new section 1907.1.2. This portion of the proposed revision is editorial and clarifies that thickness criteria are for concrete slabs-on-ground.

Modifications shown as new section 1907.1.3. This portion of the proposed revision is editorial and appropriately assigns provisions for vapor retarders to vapor retarders and not to slabs-on-ground.

ACI, a 501.C.3 professional society, encourages the approval of this code change proposal to improve the IBC by more clearly advising the user that these provisions are only applicable to slabs-on-ground and relocates slab-on-ground provisions in one section.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
No change to cost of design or construction, change places slab related criteria in one section.

S144-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee's majority opinion was that the proposed wording was less clear than the existing code wording (especially for section 1907.1.1).

(Vote: 10-4)

Assembly Action:

None

S144-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1901.2, SECTION 1907, 1907.1, 1907.1.1 (New), 1907.2 (New), 1907.3 (New)

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Precast concrete diaphragms in buildings assigned to *Seismic Design Category C, D, E or F* shall be designed in accordance with the requirements of ASCE 7, Section 14.2.4.

SECTION 1907 SLABS-ON-GROUND

1907.1 General. Slabs-on-ground ~~not transmitting vertical loads or lateral forces from other parts of the structure to the soil shall be~~ designed and constructed in accordance with section 1904 and this section.

1907.1.1 Slabs-on-ground transmitting loads. Where slabs-on-ground transmit vertical loads or lateral forces from other parts of the structure to the soil design and construction of slabs-on-ground shall comply with all applicable provisions of this chapter ~~all provisions in this Chapter shall be applicable.~~

1907.2 Thickness. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm).

1907.3 Vapor retarder. A polyethylene vapor retarder having a minimum 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder thickness and with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exceptions: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.

2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where *approved* based on local site conditions.

Commenter's Reason: This public comment clarifies that provisions of the code for slabs-on-ground are not altered. This code change proposal corrects the IBC by clearly communicating that the provisions are only minimum requirements for slabs-on-ground and not applicable to all slabs, including interim floor slabs.

This change is not intended to alter any the requirements of the code but places vapor retard provisions in a section titled vapor retarders, thickness in a section title thickness, and design and construction requirements in the appropriate section.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to the provisions, language changed and reorganized for clarity.

Public Comment# 1333

S146-19

IBC@: 1901.5

Proposed Change as Submitted

Proponents: Stephen Szoke, American Concrete Institute, representing American Concrete Institute (steve.szoke@concrete.org); Scott Campbell, National Ready Mixed Concrete Association, representing National Ready Mixed Concrete Association (scampbell@nrmca.org); Amy Trygestad, representing Concrete Reinforcing Steel Institute (atrygestad@crsi.org)

2018 International Building Code

Delete without substitution:

~~1901.5 Construction documents. The construction documents for structural concrete construction shall include:~~

- ~~1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.~~
- ~~2. The specified strength or grade of reinforcement.~~
- ~~3. The size and location of structural elements, reinforcement and anchors.~~
- ~~4. Provision for dimensional changes resulting from creep, shrinkage and temperature.~~
- ~~5. The magnitude and location of prestressing forces.~~
- ~~6. Anchorage length of reinforcement and location and length of lap splices.~~
- ~~7. Type and location of mechanical and welded splices of reinforcement.~~
- ~~8. Details and location of contraction or isolation joints specified for plain concrete.~~
- ~~9. Minimum concrete compressive strength at time of posttensioning.~~
- ~~10. Stressing sequence for posttensioning tendons.~~
- ~~11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.~~

Reason: This code change proposal removes an incomplete list of criteria necessary for the construction documents applicable to structural concrete. The list in the IBC is not as comprehensive as the list in referenced ACI documents. Many of the omissions from the IBC list are shown in the table below. Since the IBC supersedes referenced ACI documents the partial list in the IBC is all that would be required although ACI documents have significantly more extensive requirements. If the list in the IBC is to indicate what may be of particular importance to the building code official, then that list might be best included in the commentary to the IBC, but not provided as the applicable requirements for construction documents. Further maintaining duplicate lists becomes problematic and results code change proposals that would not alter the requirements. The list in the IBC is outdate and many important items recently added to ACI documents are not addressed, in particular note the requirements for anchors and qualifications for personnel.

IBC Requirements	ACI Requirements
	Loads used in design
	Design work delegated to contractor
	Cementitious materials and combinations
	Water cement ratio
	Aggregates
	Mixing water
	Admixtures
	If water reducing – amount of modification
	If retarding – modification in setting time
	Where expansive cements are used – admixture compatibility
	Steel fiber reinforcement
Compressive strength of concrete	Compressive strength of concrete
	Test age for compressive strengths
	Maximum water cement ratio
	Maximum size of aggregate
	Exposure Category F – air content
	Exposure Class C – chloride ion limits
	Exposure Class S – types of cement
	Density of lightweight aggregate

	Volumetric fracture of aggregates where required in design
	Where used for shear – requirements for steel-fiber reinforced concrete
	Exposure class at option of engineer
	Compressive strength as various phases at option of engineer.
	Concrete mix proportions
	Material storage
	Concrete batching, mixing, and transport/delivery
	Pump pipe requirements
	Concrete placement
	Vertical lift requirements
	Field cured specimens if required
	Temperature of high early strength concrete
	Accelerated curing requirements if employed
	Protection and curing concrete
	Cold weather concrete procedures if applicable
	Hot weather concrete procedures if applicable
	Locations where slab column interfaces are integrated
	Locations where steel-fiber reinforcement is required
	Saw cutting locations
Strength or grade of reinforcement	Designation and grade of reinforcement
Size and location of elements	Size and location of members
	Tolerance of members
Size and location of reinforcement	Size and location of reinforcement
	Tolerances for reinforcement
	Designation of protective coatings
	Mill reports
	Field bending of reinforcement
Provisions for dimensional change	Provisions for dimensional change
	Qualifications of anchors
	Type, size, location requirements, effective embedment depth, and installation requirements for anchors
	For adhesive anchors, minimum age of concrete, concrete temperature range, moisture condition of concrete at time of installation, type of lightweight concrete if applicable, and requirements for hole drilling and preparation
	Qualifications for anchor installers
	Corrosion protect for exposed anchors
	Type, size, details, and location of embedments
	Details of lifting devices, embedments, and related reinforcement required to resist temporary loads from handling, storage, transportation, and erection, where designed by the licensed design professional.
Magnitude and location of prestressing forces	Magnitude and location of prestressing forces
Anchor and lap splice lengths	Anchor and lap splice lengths
Type and location of welded and mechanical splices	Type and location of welded and mechanical splices
	Type and location of end-bearing splices

Details and location of construction joints	Details and location of construction joints
	Design of construction joints
	Surface preparation
	Shear transfer where required
Minimum compressive strength for post-tensioning	Minimum compressive strength for post-tensioning
Post-tensioning stressing sequence	Post-tensioning stressing sequence
	Tolerances for tendons
	Materials and details of corrosion protection for tendons, couplers, end fittings, post-tensioning anchorages, and anchorage regions.
	Requirements for grouting of bonded tendons, including maximum water-soluble chloride ion
	Formwork, including removal
	Qualifications of filed technicians
	Qualifications of inspectors
	Qualifications of testing agency and technicians
Slab on grade resisting seismic forces.	Identify if a slab-on-ground is designed as a structural diaphragm or part of the seismic-force-resisting system

ACI, a 501.C.3. professional technical society, recommends approval of this code change as submitted to assure that all relevant requirements for structural concrete as included on construction documents and to reduce confusion and eliminate the need to maintain duplicate lists.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal removes potential conflicts between the IBC and ACI requirements for construction documents.

S146-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed concerns that the proposal would make it harder to find requirements. The committee encourages ACI to update to the IBC list.
(Vote: 12-2)

Assembly Action:

None

S146-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Submitted

Commenter's Reason: The truncated list that appears in the IBC is substantially different from the requirements in ACI 318 creating a conflict within the IBC. Section 1901.1 requires compliance with ACI 318, yet the provisions of section 1901.5 of the IBC provides a less complete list of information required on the construction documents. Maintaining different lists in the IBC than the referenced documents is not appropriate and is

misleading when the intent is that all the requirements listed in ACI 318 are applicable.

As stated in the reason statement for the original proposal reason statement and in testimony, if a truncated list is important to highlight items of importance to the building official then this list should be in commentary and not the code.

One committee person suggested that ACI should duplicate the list in the IBC. There is no reason to duplicate the entire list in the IBC since the list is complete in ACI 318 which is a referenced standard. Further, it is not efficient use of anyone's time to maintain and coordinate duplicate lists.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment and the original proposal to not increase or decrease costs. The provisions of ACI 318 remain applicable.

Public Comment# 1336

S153-19

IBC@: 1907.1, ASTM Chapter 35 (New)

Proposed Change as Submitted

Proponents: Terry Kozlowski, representing Southern Nevada Chapter; Nenad Mirkovic, representing City of Las Vegas; Amanda Moss, representing SN-ICC Member; Cassidy Wilson, representing SN-ICC Member

2018 International Building Code

Revise as follows:

1907.1 General. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm). A ~~6-mil (0.006 10-mil (0.010 inch; 0.15-0.254 mm)~~ polyethylene vapor retarder conforming to ASTM E 1745 Class A requirements with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed and heated at a later date.
5. Where *approved* based on local site conditions.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

Reason: By coordinating the requirements for the vapor retarder with the American Concrete Institute (ACI) recommendations, this proposal will promote consistency across codes and standards for various moisture conditions.

Bibliography: ACI 302.2R Section 9.3:

"...ACI 302.1R recommends a minimum 10 mil (0.25 mm) vapor retarder thickness when the retarder is protected with a granular fill. When the vapor retarder is not protected by a fill, some specifiers require a 15 mil (0.38 mm) thickness or greater..."

Cost Impact: The code change proposal will increase the cost of construction

This proposal will increase the cost of construction by an estimated \$0.045/sq foot, based on cost analysis in current market conditions. For example, a 50,000 square foot commercial building will have an estimated increase of \$2,250.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E1745-17, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S153-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee did not feel there was sufficient justification to increase the thickness from 6mil to 10mil.
(Vote: 14-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: 1907.1

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

1907.1 General. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm). A ~~6-mil to 10-mil (0.006 to 0.010 inch; 0.152 mm mm)~~ polyethylene vapor retarder conforming to at least the Class C requirements of ASTM E 1745 ~~Class A requirements~~ with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed and heated at a later date.
5. Where *approved* based on local site conditions.

Commenter's Reason: This code change proposal reduces the minimum thickness from 10 mil to 6 mil and reduces the specified class of materials conforming to ASTM E1745 from Class A to Class C.

These changes are intended to better align the provisions in the IRC with the recommendations of ACI Committee 302 on Construction of Concrete Floors as published in ACI 302.2R Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials which reads: "In the past, 4, 6, 8, and 10 mil (0.10, 0.15, 0.20, and 0.25 mm) low-density polyethylene sheets have been used as belowslab vapor retarder material. Any material used as a belowslab vapor retarder/barrier, however, should conform to the requirements of ASTM E 1745, 'Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.'"

Since ACI 302.2R does not specify class, this public comment reduces the class to the minimum requirements of ASTM E1745 which is Class C.

Since ACI 302.2R does not specify thickness, as long as the material satisfies ASTM E1745 it would be preferable to not specify minimum thickness in the IBC. However, during the Committee Action Hearings arguments were made that 6 mil polyethylene sheet is not sufficiently durable for applications as belowslab vapor retarders. ASTM E1745 does not specify materials and thus arguments made that 6 mil polyethylene sheet might not be sufficiently durable may not be applicable to 6 mil membranes made of other materials. Since 6 mil was permitted in the 2018 IBC, this public comment reverts back to that as the minimum thickness. Regardless of thickness, the material must conform to ASTM E1745.

Bibliography: 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. By limiting the criteria of this provision to any material conforming to ASTM E1745 and allowing minimum thickness of 6 mil, this provision should not significantly increase the cost of construction as compared to the 2018 edition of the IBC, but could reduce costs compared to the the new provision presented as S153-19.

Public Comment# 1357

S154-19

IBC: 1907.2 (New)

Proposed Change as Submitted

Proponents: Amy Dowell, Post-Tensioning Institute, representing Post-Tensioning Institute (amy.dowell@post-tensioning.org); Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

2018 International Building Code

1808.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* or *PTI DC 10.5*. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *PTI DC 10.5*. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

Add new text as follows:

1907.2 Post-tensioned concrete slabs-on-ground. Post-tensioned concrete slabs placed on expansive or stable soils shall be designed in accordance with PTI DC-10.5.

Reason: There are currently no provisions for designing post-tensioned slabs on stable soils in IBC. The updated PTI standard, PTI DC10.5-19 has been updated to include stable soils. This title of the reference document has been changed to: PTI DC10.5-19 Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils.

Post-tensioned slabs are commonly used on stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Additional documentation can be viewed at [http://ww2.post-tensioning.org/PDF_FILES/190102-DC10.5-Expansive and Stable Soils-Public Review.pdf](http://ww2.post-tensioning.org/PDF_FILES/190102-DC10.5-Expansive%20and%20Stable%20Soils-Public%20Review.pdf).

Bibliography: .

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Post-tensioned slabs are commonly used on expansive and stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

S154-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee could find sufficient justification to add the provision to the code and unfortunately the committee could not question the proponent (not present).

(Vote: 14-0)

Assembly Action:

None

S154-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 1907.1

Proponents:

Amy Dowell, Post-tensioning Institute, representing Post-Tensioning Institute (amy.dowell@post-tensioning.org); Stephen Szoke, representing

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

1907.1 General. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm). Post-tensioned concrete slabs shall be designed in accordance with PTI DC10.5. A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where *approved* based on local site conditions.

Commenter's Reason: Slab-on-ground foundations on stable and expansive soils are often post-tensioned and there is currently no design standard in the code to guide designers. The PTI DC10.5: Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive and Stable Soils is already referenced (Section 1808.6.2) for expansive soils and there is no parallel reference for stable soils. The added reference in this section clarifies that the standard shall be used for design of a post-tensioned concrete slab, not just for expansive soil sites.

The industry has a history of successful designs of post-tensioned slab-on-ground foundations on stable soil sites. Benefits include crack reduction, as well as reduced steel and concrete use. To demonstrate the history of post-tensioned slab-on-ground foundations, the following examples are two such regions where stable soils are common and post-tensioned slab-on-ground foundations have been successfully designed using PTI DC10.5 design principles:

1. Las Vegas, NV - one designer estimates that 50% of the post-tensioned slab-on-ground foundations constructed in the region are on stable soil sites and are designed using PTI DC10.5 design principles. Examples of slab-on-ground construction on stable sites are seen in the attached photos.

2. in the Southern US, one post-tensioning supplier reports the following statistics for slabs constructed on stable soil sites:

Projects on Stable Soil Sites - Florida Example

<u>Year</u>	<u># Contractors</u>	<u>#Projects</u>	<u>Total Project Square Footage</u>
2014	3	10	1,113,693
2015	4	12	789,948
2016	4	23	2,640,620
2017	3	12	1,074,341
2018	4	16	1,113,693
2019 (ytd)	5	16	1,970,864





Bibliography: PTI DC10.5-19: Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive and Stable Soils

https://www.post-tensioning.org/publications/store/productdetail.aspx?ItemID=DC105&Language=English&Units=US_AND_METRIC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Post-tensioned slabs are commonly used on expansive and stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Public Comment# 1779

S156-19

IBC: 2109.2.4.8, 2109.2.4.8.1 (New), 2109.2.4.8.2 (New), 2109.2.4.8.3 (New), 2109.2.4.8.4 (New), 2109.2.4.8.5 (New), 2109.2.4.8.6 (New)

Proposed Change as Submitted

Proponents: K. Ben Loescher, AIA, Loescher Meachem Architects, representing Self (bloescher@lmarchitectsinc.com); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, representing DCAT (strawnet@gmail.com)

2018 International Building Code

Delete and substitute as follows:

~~**2109.2.4.8 Exterior finish.** Exterior walls constructed of unstabilized adobe units shall have their exterior surface covered with not fewer than two coats of Portland cement plaster having a minimum thickness of $\frac{3}{4}$ inch (19.1 mm) and conforming to ASTM C926. Lathing shall comply with ASTM G1063. Fasteners shall be spaced at 16 inches (406 mm) on center maximum. Exposed wood surfaces shall be treated with an approved wood preservative or other protective coating prior to lath application.~~

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this code, and shall comply with the provisions of this section and with Chapter 14, except where stated otherwise in this section.

Add new text as follows:

2109.2.4.8.1 Purpose, and type. Unstabilized adobe masonry walls shall be finished on their exterior with a plaster of any type in this section to provide protection from weather in accordance with this code.

2109.2.4.8.2 Vapor retarders and vapor permeance. Class I and II vapor retarders shall not be used on any adobe masonry wall, nor shall any other material be used that has a vapor permeance rating of less than 5 perms.

2109.2.4.8.3 Plaster thickness and coats. Plaster applied to adobe masonry shall be not less than 7/8" (22 mm) and not greater than 2 inches (51 mm) thick. Plaster shall be applied in not less than two coats.

2109.2.4.8.4 Plaster application. Plaster shall be applied directly to adobe masonry walls without any type of membrane to facilitate transpiration of moisture from the masonry units, and to secure a mechanical bond between the masonry and plaster.

2109.2.4.8.5 Lath for plaster. Lath shall be provided for all plasters, except as otherwise not required in this section. Fasteners shall be spaced at 16 inches (406mm) on center maximum. Metal lath shall comply with ASTM C1063, as modified by this section, and shall be corrosion resistant. Plastic lath shall comply with ASTM C1788, as modified by this section.

2109.2.4.8.6 Cement plaster. Cement plaster shall conform to ASTM C926 and shall comply with Chapter 25, except that the proportion of lime in plaster coats shall not be less than 1 part lime to 6 parts cement to allow a minimum acceptable vapor permeability. The combined thickness of plaster coats shall not be more than 1 inch (25mm).

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

C1788-14: Standard Specification for Non Metallic Plaster Bases (Lath) Used with Portland Cement Based Plaster in Vertical Wall Applications

Reason: Even more than wood frame or conventional masonry structures, adobe walls require vapor permeable finishes to ensure appropriate performance and service life; moisture that is trapped within adobe wall assemblies can cause failures due to finish separation, salt attack, coving and freeze-thaw related spalling. Although it is accepted that earthen walls require vapor permeable finishes to adequately manage moisture in the assembly and prevent various structural and finish pathologies, existing code language remains based on legacy language that predates current building science. Notably, while stabilized adobes do not require any exterior finishes, unstabilized adobes are required to be finished with conventional cement stucco, a finishing system that without modification has been shown to be insufficiently permeable. Research has shown that simply increasing the lime proportion in ordinary cement plasters can increase vapor permeability to acceptable levels.

Other comments related to this proposal:

- *Necessity: Unstabilized adobe masonry walls are subject to erosion from precipitation. As most of Section 2109 presumes that adobe masonry is used in structural applications, protective finishes are required to prevent structural failures from erosion, coving, and freeze/thaw related spalling.*
- *It is accepted that earthen building materials require exterior finishes that are vapor permeable in order to facilitate drying from moisture that may enter the wall assembly through roof or finish defects, condensation, plumbing failures, flooding, and capillary action from adjacent construction. In the presence of moisture and in the absence of vapor permeable finishes, earthen wall systems are subject to failure due to loss of integrity of the clay/sand matrix, liquification and/or salt-attack. (ASTM E2392)*

- *Plaster Thickness: The 7/8" minimum thickness requirement is identical to one that has existed successfully in the New Mexico Earthen Building Materials Code. Limits on the maximum thickness of applied plasters are required to ensure that the applied renders are securely bonded to the substrate. The New Mexico Earthen Building Materials Code includes no limit on the thickness of plasters; the 2" maximum proposed here is identical to that currently existing in IRC Appendix S.*
- *Vapor Retarders: Class I and II vapor retarders are prohibited here as they are effectively impermeable, having perm ratings of less than 1.*
- *Minimum Perm Rating: Although in many cases higher permeability would be desirable, for purposes of this proposal a minimum perm rating of 3.5 has been established as it allows the use of a 1:1:6 lime amended cement stucco with an applied siloxane water repellent (3.54 perms at 41 mm of thickness per Straube). 1:1:6 stuccos are applied with the same methods as 1:3 stuccos, at similar cost, and have similar durability. Surface applied siloxane based water repellents are effective at inhibiting water infiltration through plaster skins and desired by industry.*
- *Direct application is required as intermediate substrates may inhibit the beneficial outward movement of moisture, and introduces questions of mechanical attachment that cannot adequately be addressed within the scope of this proposal.*
- *Metallic laths are conventionally used for Portland cement based plasters. Requirements and conditions for their use need to be provided.*
- *ASTM C 1063: "Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster". This is the reference standard used elsewhere in the IBC to describe the material and practice requirements for the installation of metallic lathing.*
- *ASTM C926: This Standard Specification for the Application of Cement Stucco is the accepted reference standard for the materials and practices associated with cement stuccos.*
- *Lime requirement: Complimentary to the minimum vapor permeability requirements, this section requires lime to be added to cement stuccos. The constituents of conventional cement stuccos sometimes vary but are typically 1 part cement to 3 parts sand; based on Straube, this formulation yielded only 0.68 perms. The formulation proposed by this section yields 5.13 perms at 35 mm in thickness, or 3.54 perms at 41 mm of thickness when treated with siloxane, providing adequate (but not optimal) permeability while retaining desirable durability characteristics and application procedures of conventional cement stuccos. In both cases, permeability exceeds 5 perms at a 25mm (conventional applied thickness)*
- *Maximum Thickness: Limits on the thickness of applied plasters are required to ensure that the applied renders are securely bonded to the substrate. the 1 1/2" maximum proposed here is identical to that currently existing in IRC Appendix S, the 1" maximum for cement based plasters is required to achieve permeability of greater than 5 perms.*
- *Vapor Permeability of various finishes (per Straube):*

Sample	t [mm]	Permeance [ng/Pa s m ²]	Permeability [ng/Pa s m]	US Perms
Cement :Sand				
1:3 datum	43.5	39	1.7	0.68
1:3 elastomeric coating	39.5	40	--	0.70
1:3 siloxane	41.0	40	1.7	0.70
Cement:Lime:Sand				
1:1:6 datum	35	295	10.3	5.13
1:1:6 linseed	36	223	8.0	3.89
1:1:6 elastomeric	32.5	244	--	4.25
1:1:6 siloxane	41	203	8.3	3.54
1:1:6 calcium stearate	53.5	81	4.3	1.42
1:1:6 calcium stearate	44	142	6.2	2.47
1:1:6 calcium stearate	53.5	41	2.2	0.71
1:1:6 latex paint	36.5	203	--	3.54
1:1:6 oil paint	40	41	--	0.71
Cement:Lime:Sand				
1:2:9 datum	50.5	295	14.9	5.13
1:2:9 linseed	50.5	259	13.1	4.52
Lime:Sand				
1:3 Datum	33.5	565	18.9	9.85
1:3 Datum	35.5	529	18.8	9.22
1:3 Quicklime	32	459	14.7	8.00

Table 2.3: Results of Vapor Permeance Test Results [Straube, 2000]

Bibliography: 2015 New Mexico Earthen Building Materials Code
2015 *International Residential Code Appendix S - Strawbale Construction*

Adobe Conservation: A Preservation Handbook. Compiled by the Technical Staff of Cornerstones Community Partnership. Sunstone Press (Santa Fe, 2006)

ASTM E2392 / E2392M - 10(2016) Standard Guide for Design of Earthen Wall Building Systems

Building with Earth: Design and Technology of Sustainable Architecture. Gernot Minke, Birkhauser (Bern, 2009)

Earth Construction: A Comprehensive Guide. Hugo Houben and Hubert Guillaud, Practical Action Publishing (Rugby, 2008).

Moisture Properties of Plaster and Stucco for Strawbale Buildings. John Straube. (EBNET, 2019)

Sustainable Building with Earth. Horst Schroeder, Springer International Publishing (Switzerland, 2016)

Cost Impact: The code change proposal will decrease the cost of construction

In most cases, the proposed code language expands the options available to design professionals and contractors for the finishing of adobe wall systems without additional cost impact. The inclusion of earthen plasters in particular cases will decrease the cost of construction for some projects.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM C1788-14, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S156-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee found the proposal as written to be confusing and possibly more suited for an appendix.
(Vote: 11-3)

Assembly Action:

None

S156-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 2109.2.4.8, 2109.2.4.8.1 (New), 2109.2.4.8.2 (New), 2109.2.4.8.3 (New), 2109.2.4.8.4 (New), 2109.2.4.8.5 (New), 2109.2.4.8.6 (New)

Proponents:

Ben Loescher, representing The Earthbuilders' Guild (bloescher@lmarchitectsinc.com); David Eisenberg, DCAT, representing DCAT (strawnet@gmail.com); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this code and shall comply with the provisions of this section and or with Chapter 14, except where stated otherwise in this section.

2109.2.4.8.1 Purpose, and type Where required. Unstabilized adobe masonry walls shall be finished on their exterior with a plaster of any type in this section to provide protection from weather. receive a weather protective exterior finish in accordance with this code Section 2109.2.4.8.

2109.2.4.8.2 Vapor retarders and v Vapor permeance. Glass I and II vapor retarders shall not be used on any adobe masonry wall, nor shall any other material be used that has a vapor permeance rating of less than 5 perms. Plaster and finish assemblies shall have a vapor permeance of not less than 5 perms.

Exception: Insulation products applied to the exterior of stabilized adobe masonry walls in Climate Zones 2B, 3B, 4B and 5B shall have no vapor permeance requirement.

2109.2.4.8.3 Plaster thickness and coats. Plaster applied to adobe masonry shall be not less than 7/8" (22 mm) and not greater than 2 inches (51 mm) thick. Plaster shall be applied in not less than two coats.

2109.2.4.8.4 Plaster application. Plaster shall be Where plaster is applied directly to adobe masonry walls, no intermediate membrane shall be used, any type of membrane to facilitate transpiration of moisture from the masonry units, and to secure a mechanical bond between the masonry

and plaster.

2109.2.4.8.5 Lath for plaster. Lath shall be provided for all plasters, except ~~as otherwise where not required elsewhere in this section~~ Section 2019.2.4.8. Fasteners shall be corrosion resistant and spaced at a maximum of 16 inches (406mm) on center ~~maximum with a minimum 1-1/2 inches (38 mm) penetration into the adobe wall~~. Metal lath shall comply with ASTM C1063, as modified by this section, and shall be corrosion resistant. Plastic lath shall comply with ASTM C1788, as modified by this section. Wood substrates shall be protected with #15 asphalt felt, an approved wood preservative or other protective coating prior to lath application.

2109.2.4.8.6 Cement plaster. Cement plaster shall conform to ASTM C926 and shall comply with Chapter 25, except that the proportion of lime in plaster coats shall not be less than 1 part lime to 6.4 parts cement ~~to allow a minimum acceptable vapor permeability~~. The combined thickness of cement plaster coats shall not be ~~more than~~ exceed 1 inch (25mm).

Commenter's Reason: Proposal S156-19 was the first of a set of four proposals addressing finishes on adobe walls. This set of proposals was intended to address a serious flaw in the existing provisions related to the permeance of finishes on adobe walls, as well as add needed provisions for all finishes, and provide an appropriate place in the section for the addition of the finishes proposed in the following three proposals that were ultimately approved by the Committee.

Three factors resulted S156 being disapproved. Two were the result of confusion that was evident as the Committee heard proposal S156. The third was the result of concerns about wording specific to the proposal, which is addressed by this public comment.

First was the decision to separate these changes into four separate proposals, with the intention of making sure that the paramount concern, the permeance issue was addressed in S156, regardless of the potential outcome for the newly proposed plaster types that were in the other three proposals. Ironically, the outcome was the opposite when S156 was disapproved.

Second was the result of formatting and section numbering changes in the cdpACCESS process that made the four proposals appear as separate and independent from each other, rather than as S156 clearly being the overarching section under which the new sections for lime plasters, lime-cement plasters, and clay plasters proposed and approved in S157, S158, and S159 would exist. For clarity, we have included below, how the entire Adobe finishes section would appear if this public comment is approved, including the sections already approved from proposals S157-19, S158-19, and S159-19.

Third, were the Committee's specific concerns about language that needed improvement, resulting in S156 being disapproved. As the other three proposals were heard, greater clarity emerged about both the importance of addressing the permeance issue and added requirements for finishes, and the need for the structure that S156 provided for the other proposals. The Committee approved the other three proposals as submitted, in part to strengthen the case for approval of a public comment on S156. There were strong recommendations from committee members about the importance of addressing the permeance issue for finishes.

The specific changes made in response to the committee's comments are:

- eliminating ambiguity and removing language that was essentially commentary,
- clarifying language related to plaster thickness, permeance, substrates, the lathing exception, and the protection of wood substrates.
- clarifying language related to plaster thickness, permeance, substrates, the lathing exception, and the protection of wood substrates. An exception was added to allow less permeable insulation products in response to input from industry. Impermeable insulation products applied over asphalt-emulsion stabilized adobe walls have been used successfully for over thirty years in low humidity regions of the western United States. Their continued use is important to achieve energy code compliance until vapor permeable insulation products suitable for use beneath plaster or other finishes become readily available.

Note: In the Committee Reason for their vote to disapprove this proposal, there is mention of these provisions possibly being more suited for an appendix. Mention of an appendix was entirely the result of the mistaken comment of a person testifying in support having said these provisions were in an appendix. When it was pointed out that the Adobe provisions have been in the body of the IBC from the very first version, the person apologized and asked the Committee to disregard that part of his testimony. Nothing in the proposal, nor in other testimony or direct discussion among the Committee recommended moving this section to an appendix.

Background

Like traditional solid masonry walls, adobe masonry walls require vapor permeable finishes to ensure appropriate performance and service life. Moisture that is trapped within adobe wall assemblies behind impermeable finishes can lead to failures such as finish separation, salt attack, coving and freeze-thaw related spalling, and in extreme cases, structural collapse. Although this is widely known, existing language allowing non-permeable cement plasters remains in the code based on legacy language that predates current building science. Notably, while the current code does not require an exterior finish for stabilized adobe walls, it requires that unstabilized adobe walls be finished with conventional cement stucco, a finishing system that, without the modifications in this public comment, is vapor impermeable.

This proposal includes the addition of language for permeable finishes and is informed by code provisions and guidance from the 2015 *New Mexico*

Earthen Building Materials Code, ASTM E2392-10 Standard Guide for Design of Earthen Wall Building Systems, and IRC Committee approved changes for the 2021 IRC Appendix S - Strawbale Construction.

For overall clarity about how the four proposals (S156-19, S157-19, S158-19, and S159-19) were intended to relate to each other, below is how full Adobe Finishes section would look renumbered, and including the changes proposed in this public comment as well as those from the already approved proposals listed above, which are shown *italicized*:

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this section or Chapter 14, except where stated otherwise in this section.

2109.2.4.8.1 Where required. Unstabilized adobe masonry walls shall receive a weather protective exterior finish in accordance with Section 2109.2.4.8.

2109.2.4.8.2 Vapor permeance. Plaster and finish assemblies shall have a vapor permeance of not less than 5 perms.

Exception: Insulation products applied to the exterior of stabilized adobe masonry walls in Climate Zones 2B, 3B, 4B and 5B shall have no vapor permeance requirement.

2109.2.4.8.3 Plaster thickness and coats. Plaster applied to adobe masonry shall be not less than 7/8" (22 mm) and not greater than 2 inches (51 mm) thick. Plaster shall be applied in not less than two coats.

2109.2.4.8.4 Plaster application. Where plaster is applied directly to adobe masonry walls, no intermediate membrane shall be used.

2109.2.4.8.5 Lath for plaster. Lath shall be provided for all plasters, except where not required elsewhere in section 2109.2.4.8. Fasteners shall be corrosion resistant and spaced at a maximum of 16 inches (406mm) on center with a minimum 1-1/2 inches (38 mm) penetration into the adobe wall. Metal lath shall comply with ASTM C1063, as modified by this section, and shall be corrosion resistant. Plastic lath shall comply with ASTM C1788, as modified by this section. Wood substrates shall be treated with #15 asphalt felt, an *approved* wood preservative or other protective coating prior to lath application.

2109.2.4.8.6 Cement plaster. Cement plaster shall conform to ASTM C926 and comply with Chapter 25, except that the proportion of lime in plaster coats shall not be less than 1 part lime to 4 parts cement. The combined thickness of cement plaster coats shall not exceed 1 inch (25 mm).

2109.2.4.8.7 Lime Plaster. *Lime plaster is any plaster with a binder composed of calcium hydroxide, including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime, or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.*

2109.2.4.8.8 Cement-lime plaster. *Cement-lime plaster shall be any plaster mix type CL, F or FL, as described in ASTM C926.*

2109.2.4.8.9 Clay Plaster. *Clay plaster shall comply with this section.*

2109.2.4.8.9.1 General. *Clay plaster shall be any plaster having a clay or clay subsoil binder. Such plaster shall contain sufficient clay to fully bind the aggregate, and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal, and animal hair.*

2109.2.4.8.9.2 Clay subsoil requirements. *The suitability of clay subsoil shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.*

2109.2.4.8.9.3 Weather exposed locations. *Clay plaster exposed to water from direct or wind-driven rain, or snow, shall be finished with an approved erosion-resistant finish. The use of clay plasters shall not be permitted on weather exposed parapets.*

2109.2.4.8.9.4 Prohibited finish coat. *Plaster containing Portland cement shall not be permitted as a finish over clay plaster.*

2109.2.4.8.9.5 Conditions where lathing is not required. *For unstabilized adobe walls finished with unstabilized clay plaster, lathing shall not be required.*

Bibliography: 2015 New Mexico Earthen Building Materials Code

Adobe Conservation: A Preservation Handbook. Compiled by the Technical Staff of Cornerstones Community Partnership. Sunstone Press (Santa Fe, 2006)

ASTM E2392 / E2392M - 10(2016) Standard Guide for Design of Earthen Wall Building Systems

Building with Earth: Design and Technology of Sustainable Architecture. Gernot Minke, Birkhauser (Bern, 2009)

Earth Construction: A Comprehensive Guide. Hugo Houben and Hubert Guillaud, Practical Action Publishing (Rugby, 2008).

Moisture Properties of Plaster and Stucco for Strawbale Buildings. John Straube. (EBNET, 2019)

Sustainable Building with Earth. Horst Schroeder, Springer International Publishing (Switzerland, 2016)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed change has no impact on the cost of construction. In most cases, the proposed code language expands the options available to design professionals and contractors for the finishing of adobe wall systems without additional cost impact.

Public Comment# 1622

S162-19

IBC: SECTION 2209, 2209.2, 2209.3 (New), 2209.4 (New), 2209.5 (New), MHI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Paul Armstrong, MHI, representing MHI

2018 International Building Code

Revise as follows:

SECTION 2209 STEEL STORAGE RACKS MATERIAL HANDLING STRUCTURES

2209.1 Storage racks. The design, testing and utilization of *storage racks* made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.1. Where required by ASCE 7, the seismic design of *storage racks* shall be in accordance with Section 15.5.3 of ASCE 7.

2209.2 Cantilevered steel storage racks. The design, testing, and utilization of cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3. Where required by ASCE 7, the seismic design of cantilevered steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

Add new text as follows:

2209.3 Industrial boltless steel shelving. The design and utilization of industrial boltless steel shelving shall be in accordance with ANSI/MH28.2.

2209.4 Industrial steel work platforms The design and utilization of industrial steel work platforms shall be in accordance with ANSI/MH28.3.

2209.5 Stairs, ladders and guards. The design and utilization of stairs, ladders and open edge guards for use with material handling structures shall be in accordance with ANSI/MH32.1.

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte NC 28217

MH28.3-2018: Design, Testing and Utilization of Industrial Steel Work Platforms

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte NC 28217

MH28.2-2018: Design, Testing and Utilization of Industrial Boltless Steel Shelving

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte NC 28217

MH32.1-2018: Stairs, Ladders, and Open-Edge Guards for Use with Material Handling Structures

Reason: SMA has developed new standards for the design, testing and installation of both steel work platforms and boltless steel shelving structures. They are ANSI accredited now and are included for review.

Cost Impact: The code change proposal will decrease the cost of construction. These standards will reduce the cost of construction by providing a uniform set of code regulations for the design and installation of such structures. Currently the imposed regulations seem to change based on the jurisdiction and/or plan reviewer.

Staff Analysis: A review of the standard proposed for inclusion in the code, MHI MH28.2-2018, MH28.3-2018 and MH32.1-2018, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S162-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent requested disapproval. The committee felt the proposed list was incomplete and possibly being proposed for the wrong place in the code. (Vote: 10-4)

Assembly Action:

None

S162-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 2209.3 (New), 2209.4 (New)

Proponents:

Paul Armstrong, MHI, representing MHI (paul.armstrong@pacodeservices.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

2209.3 Industrial boltless steel shelving. The design and utilization of industrial boltless steel shelving shall be in accordance with ANSI/MH28.2 as amended by 2209.3.1 through 2209.3.3.

2209.3.1 Section 1.1. Modify Section 1.1, by adding a concluding paragraph as follows: "Designers are cautioned when doing seismic design to obtain more detailed information, amendments and changes to adopted codes, including applicable design ground motions to use for design, by contacting the local jurisdiction where the racks are to be installed".

2209.3.2 Section 4.6.2. Modify Section 4.6.2, by replacing the web site reference from <http://earthquake.usgs.gov/designmaps/us/application.php> to <http://www.seaoc.org/page/seismicdesignmaptool>.

2209.3.3 Section 4.6.6. Modify Section 4.6.6, by replacing b) to read as follows: "b) when the loss of seismic-resistance capacity in a single beam, post, or brace does not result in more than a 33% reduction in required seismic-resistance capacity of the structure (in the cross-aisle direction, this typically requires a minimum of two back-to-back rows interconnected); and".

2209.4 Industrial steel work platforms The design and utilization of industrial steel work platforms shall be in accordance with ANSI/MH28.3 as amended by 2209.4.1 and 2209.4.2

2209.4.1 Section 1.1. Modify Section 1.1, by adding a concluding paragraph as follows: "Designers are cautioned when doing seismic design to obtain more detailed information, amendments and changes to adopted codes, including applicable design ground motions to use for design, by contacting the local jurisdiction where the racks are to be installed".

2209.4.2 Section 4.6.3. Modify Section 4.6.3, by adding the following paragraph after "i) = 8 for a special moment frame.", "The use of any of the above listed 'R' values is permissible provided that the seismic detailing requirements per AISC 341-16 are followed for the selected seismic force-resisting system (does not apply to those force-resisting systems not design to resist seismic loads). Detailing requirements for structural systems not specifically detailed for seismic resistance are found in AISC 360-16. Platforms not specifically detailed for seismic resistance using an R = 3 per ASCE 7 Table 12.2-1 are restricted to Seismic Design Categories A, B and C.

Commenter's Reason: During the Code Development Committee Hearings, feedback was received from FEMA's Seismic Code Support Committee. Unfortunately, there wasn't enough time at the hearings to development a modification. This Public Comment has been developed with their input from the hearings and subsequent conference calls. It was agreed that a few other items would be reviewed and considered for the next edition of each standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This just provides design standards for the systems identified in each standard.

Public Comment# 2058

S165-19

IBC: 2303.1.9, 2303.1.9.3 (New), 2303.2, 2303.2.5, 2306.1.3

Proposed Change as Submitted

Proponents: David P Tyree, American Wood Council, representing American Wood Council (dtyree@awc.org); Paul Coats, representing American Wood Council (pcoats@awc.org)

2018 International Building Code

2303.1.9 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.12 to be preservative treated shall conform to AWPA U1 and M4. Lumber and plywood used in permanent wood foundation systems shall conform to Chapter 18.

Add new text as follows:

2303.1.9.3 Strength Adjustments. Design values for preservative-treated wood in accordance with Section 2303.1.9 do not need adjustment for the type of preservative used. Other adjustments in accordance with AWC NDS shall apply. Load duration factors for structural members pressure-treated with water-borne preservatives shall not exceed 1.6.

Revise as follows:

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a *listed* flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10¹/₂ feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.2.5 Strength adjustments. Design values for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for *fire-retardant-treated wood*. Adjustments to design values, including fastener values, shall be based on an *approved* method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the *fire-retardant-treated wood* will be subjected, the type of treatment and redrying procedures. Other adjustments in accordance with AWC NDS shall apply. Load duration factors for structural members pressure-treated with fire retardant chemicals shall not exceed 1.6.

Delete without substitution:

~~**2306.1.3 Treated wood stress adjustments.** The allowable unit stresses for *preservative-treated wood* need not be adjusted for treatment, but are subject to other adjustments.~~

~~The allowable unit stresses for *fire-retardant-treated wood*, including fastener values, shall be developed from an *approved* method of investigation that considers the effects of anticipated temperature and humidity to which the *fire-retardant-treated wood* will be subjected, the type of treatment and the redrying process. Other adjustments are applicable except that the impact load duration shall not apply.~~

Reason: Section 2306.1.3 is redundant with Section 2303.2.5 and can be deleted. Location of design value information in 2303.2.5 as opposed to 2306 on Allowable Stress Design is preferable as information in 2305 is generally applicable and addresses use for both ASD and LRFD. Portions of 2306.1.3 not addressed by 2303.2.5 are moved to 2303.2.5 and a new section (2303.1.9.3) on strength adjustments for preservative treated wood. Additional description of specific revisions follows:

Section 2303.1.9.3. Sentence 1 clarifies that no adjustment is associated with the type of preservative used. The second sentence is consistent with AWC NDS Table 2.3.2 in which load duration adjustment is not to exceed 1.6 for structural members pressure treated with water-borne preservatives and is a smaller adjustment than the factor of 2.0 associated with impact load duration.

Section 2303.2.5. The second sentence is consistent with AWC NDS Table 2.3.2 in which load duration adjustment is not to exceed 1.6 for structural members pressure treated with fire-retardant chemicals and is a smaller adjustment than the factor of 2.0 associated with impact load duration.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Clarification of current requirements and referenced standards.

S165-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee expressed apprehension that the proposal had not been vetted and coordinated throughout the industry.

(Vote: 14-0)

Assembly Action:

None

S165-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 2303.1.9, 2303.1.9.3 (New), 2303.2, 2303.2.5, 2306.1.3

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

2303.1.9 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.12 to be preservative treated shall conform to AWPAC U1 and M4. Lumber and plywood used in permanent wood foundation systems shall conform to Chapter 18.

2303.1.9.3 Strength Adjustments. Design values for preservative-treated wood in accordance with Section 2303.1.9 do not need adjustment for the type of preservative used. Other adjustments in accordance with AWC NDS shall apply. Load duration factors for structural members pressure-treated with water-borne preservatives shall not exceed 1.6.

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a *listed* flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10¹/₂ feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.2.5 Strength adjustments. Design values for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for *fire-retardant-treated wood*. Adjustments to design values, including fastener values, shall be based on an *approved* method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the *fire-retardant-treated wood* will be subjected, the type of treatment and redrying procedures. ~~Other adjustments in accordance with AWC NDS shall apply. Load duration factors for structural members pressure-treated with fire-retardant chemicals shall not exceed 1.6. Duration of load factors, except impact load duration, in accordance AWC NDS shall apply.~~

2306.1.3

Treated wood stress adjustments.

Commenter's Reason: The reason statement implied that no technical changes were intended. The submission did include technical changes. This comment brings the language from 2306.1.3 into the section for FRTW.using the last sentence in the section and alerting the user to other load duration factors in the NDS.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Updating for new material.

Public Comment# 1686

Public Comment 2:

IBC@: 2303.2.5, 2303.2.5.1, 2303.2.5.2

Proponents:

Jason Smart, American Wood Council, representing American Wood Council (jsmart@awc.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

2303.2.5 Strength adjustments. Design values for ~~untreated~~ fire-retardant-treated lumber and wood structural panels shall be determined using published design values and adjustments for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for fire-retardant-treated wood elsewhere in this chapter, and further adjusted to account for the effects of treatment. Adjustments ~~to design values for the effects of treatment~~ shall be based on an *approved* method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the *fire-retardant-treated wood* will be subjected, the type of treatment and redrying procedures.

2303.2.5.1 Wood structural panels. The effect of treatment, ~~and~~ the method of redrying after treatment, and any treatment-based degradation due to exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed by ASTM D5516 shall be used to develop treatment adjustment factors, ~~maximum loads and spans, or both, for untreated plywood design values~~ in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.

2303.2.5.2 Lumber. For each species of wood that is treated, the effects of the treatment, the method of redrying after treatment, and any treatment-based degradation due to exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed by ASTM D5664 shall be used to develop modification ~~treatment~~ adjustment factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

Commenter's Reason: Section 2303.2.5 is revised to clarify that design values for fire-retardant-treated wood products are based on design values for untreated wood products that have been adjusted for end-use conditions in accordance with Chapter 23 provisions and also adjusted to account for the effect of the fire-retardant treatment. This clarification aligns with ASTM D5664/D6841 for lumber and ASTM D5516/D6305 for plywood. In both cases, the FRT adjustment factors isolate the additional effect of the fire-retardant treatment, but do not address how the constituent untreated wood materials themselves need to be adjusted for typical application conditions. For this reason, design values for FRT wood products must be adjusted by factors that are applicable to untreated wood as well as the treatment adjustment factors.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The revisions in this public comment simply provide a clarification of what is already required for designs utilizing fire-retardant-treated wood products.

Public Comment# 2012

Public Comment 3:

IBC®: 2303.1.9, 2303.1.9.3 (New), 2303.2, 2303.2.5, 2303.2.5.1, 2303.2.5.2, 2306.1.3

Proponents:

Jason Smart, American Wood Council, representing American Wood Council (jsmart@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

2303.1.9 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.12 to be preservative treated shall conform to AWPA U1 and M4. Lumber and plywood used in permanent wood foundation systems shall conform to Chapter 18.

2303.1.9.3 Strength Adjustments. Design values for ~~preservative-treated wood in accordance with Section 2303.1.9 do not need adjustment for the type of preservative used. Other adjustments in accordance with AWC NDS shall apply. Load duration factors for structural members pressure-treated with water-borne preservatives shall not exceed 1.6.~~

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a *listed* flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10¹/₂ feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.2.5 Strength adjustments. Design values for ~~untreated~~ fire-retardant-treated lumber and wood structural panels shall be determined using

~~published design values and adjustments for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for fire-retardant-treated wood elsewhere in this chapter, and further adjusted to account for the effects of treatment. Adjustments to design values, including fastener values, for the effects of treatment shall be based on an approved method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures. Other adjustments in accordance with AWC NDS shall apply. Load duration factors for structural members pressure-treated with fire-retardant chemicals shall not exceed 1.6.~~

2303.2.5.1 Wood structural panels. The effect of treatment, ~~and~~ the method of redrying after treatment, and any treatment-based degradation due to exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed by ASTM D5516 shall be used to develop treatment adjustment factors, maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.

2303.2.5.2 Lumber. For each species of wood that is treated, the effects of the treatment, the method of redrying after treatment, and any treatment-based degradation due to exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed by ASTM D5664 shall be used to develop modification treatment adjustment factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80° F (27° C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

2306.1.3 Treated wood stress adjustments. The allowable unit stresses for preservative treated wood need not be adjusted for treatment, but are subject to other adjustments.

The allowable unit stresses for fire-retardant-treated wood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and the redrying process. Other adjustments are applicable except that the impact load duration shall not apply.

Commenter's Reason: Section 2303.1.9.3, which was proposed as a new section in S165-19, is removed by this public comment. The net result is that no changes are proposed under Section 2303.1.9, based on the 2018 IBC.

Section 2303.2.5 is revised to clarify that design values for fire-retardant-treated wood products are based on design values for untreated wood products that have been adjusted for end-use conditions in accordance with Chapter 23 provisions and also adjusted to account for the effect of the fire-retardant treatment. This clarification aligns with ASTM D5664/D6841 for lumber and ASTM D5516/D6305 for plywood. In both cases, the FRT adjustment factors isolate the additional effect of the fire-retardant treatment, but do not address how the constituent untreated wood materials themselves need to be adjusted for typical application conditions. For this reason, design values for FRT wood products must be adjusted by factors that are applicable to untreated wood as well as the treatment adjustment factors.

Section 2306.1.3, which was proposed for deletion in S165-19, is reinstated by this public comment. The net result is that no changes are proposed to Section 2306.1.3, based on the 2018 IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The revisions in this public comment simply provide a clarification of what is already required for designs utilizing fire-retardant-treated wood products.

Public Comment# 2040

Proposed Change as Submitted

Proponents: Marcelo M Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Building Code

Revise as follows:

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a *listed* flame spread index of 25 or less ~~and show no evidence of significant progressive combustion when the test is continued~~ Additionally, the ASTM E84 or UL 723 test shall be continued for an additional 20-minute period. ~~Additionally, and~~ the flame front shall not progress more than 10½ feet (3200 mm) beyond the centerline of the burners at any time during the ~~test.~~ extended 30-minute test.

Reason: This issue has been under discussion for many years at the ICC codes, as well as at ASTM and at NFPA, but can now be resolved in the IBC code. Fire test labs have been surveyed and they all agree that there are only two fire test requirements: a flame spread index of not more than 25 in the standard ASTM E84 test and a flame front that does not progress more than 10½ feet beyond the centerline of the burners when the ASTM E84 test is extended for a total test time of 30 minutes.

The ASTM E5 committee, responsible for ASTM E84, has now, for the first time, accepted incorporating requirements for conducting a 30 minute test. Until this change ASTM E84 did not contain any information other than that it is a 10 minute test. Consequently, until this change ASTM E84 did not provide any details on how to assess either "no evidence of significant progressive combustion" or "the flame front shall not progress more than 10½ feet (3200 mm) beyond the centerline of the burners". The information for how to determine both of those characteristics is contained in ASTM E2768. The committee agreed that the next edition of ASTM E84 will state that a 30 minute test is to be conducted per ASTM E2768. In turn, ASTM E2768 explains that "no significant progressive combustion" is evidenced by lack of flame front progress beyond 10 1/2 feet. In fact ASTM E2768 states: "The flame front shall not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners at any time during the 30 min test period. This is considered evidence of no significant progressive combustion in this test method." This IBC proposal incorporates the requirements from the ASTM E84 test into the IBC and ensures that the code does not require a duplicate (and confusing) measurement.

It is likely that information will be presented stating that "no significant progressive combustion" has been in the code since the legacy codes and that the flame front progress requirement was added later. That is exactly the reason that ASTM E2768 was developed to ensure that everyone understands what is to be measured, and that is what the testing laboratories have been doing for many years now.

This change appears to alter requirements but in fact simply recognizes what the ASTM E84 standard states and what the labs are doing (and have been doing for years) and, therefore, is really clarification.

The committee E05 (on fire standards) agreed at the December 2018 meeting that the scope of ASTM E84 should read as follows:

1. Scope

1.1 This fire-test-response standard for the comparative surface burning behavior of building materials is applicable to exposed surfaces such as walls and ceilings. The test is conducted with the specimen in the ceiling position with the surface to be evaluated exposed face down to the ignition source. The material, product, or assembly shall be capable of being mounted in the test position during the test. Thus, the specimen shall either be self-supporting by its own structural quality, held in place by added supports along the test surface, or secured from the back side.

1.2 Test Method E84 is a 10-minute fire-test response method. The following standards address testing of materials in accordance with test methods that are applications or variations of the test method or apparatus used for Test Method E84:

1.2.1 Materials required by the user to meet an extended 30-min duration tunnel test shall be tested per Test Method E2768.

1.2.2 Wires and cables for use in air-handling spaces shall be tested per NFPA 262.

1.2.3 Pneumatic tubing for control systems shall be tested per UL 1820.

1.2.4 Combustible sprinkler piping shall be tested per UL 1887.

1.2.5 Optical fiber and communications raceways for use in air handling spaces shall be tested per UL 2024.

1.3 The purpose of this test method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke developed index are reported. However, there is not necessarily a relationship between these two measurements.

1.4 The use of supporting materials on the underside of the test specimen has the ability to lower the flame spread index from those which might be obtained if the specimen could be tested without such support. These test results do not necessarily relate to indices obtained by testing materials without such support.

1.5 Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed, results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of the standard.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal recognizes what the fire test labs have been doing for years and what ASTM committee E05 has recently agreed to do in the scope of ASTM E84.

S166-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
2018 International Building Code

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a *listed* flame spread index of 25 or less. Additionally, the ASTM E84 or UL 723 test shall be continued for an additional 20-minute period and the flame front shall not progress more than 10¹/₂ feet (3200 mm) beyond the centerline of the burners at any time during the ~~extended 30-minute~~ test.

Committee Reason: The committee felt that the proposal cleaned up the language and makes the code consistent with current test methods. The modification simplified the language. (Vote: 11-2)

Assembly Action:

None

S166-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests As Modified by Committee

Commenter's Reason: As recommended by the Code Development Committee at the Committee Action Hearings, this change cleans up and simplifies the language of 2303.2, while making it more consistent with the referenced test methods.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Proposal represents a simple cleaning up of existing language.

Public Comment# 1678

Public Comment 2:

Proponents:

Manny Muniz, representing Representing self (mannymuniz.mm@gmail.com)

requests Disapprove

Commenter's Reason: This proposal is similar to RB255-19 which was disapproved by a vote of 11-0. The residential committee disapproved that proposal for several reasons and stated ***"The proposal has a lower safety standard. There was a debate on the technical justification in testing. The standard in the reason statement, ASTM E05, is not referenced in the ICC."***

The lower safety standard is the deletion of a 55-year-old prescriptive requirement for showing *"no evidence of significant progressive combustion"* following the test. Such a deletion is arbitrary as there was no testing done to see if safety was being lowered. That's why it was disapproved.

The Structural committee reason statement stated *"The committee felt that the proposal cleaned up the language and makes the code consistent with current test methods. The modification simplified the language."*

Making the code consistent with current test methods, as stated in the structural committee reason, is backwards as to how you change a prescriptive requirement in the code. If, in fact, a test lab felt that ***"showing no evidence of significant progressive combustion"*** following the test is equivalent to the additional prescriptive requirement that ***"the flame front shall not progress more than 10 ½ feet beyond the centerline of the burners at any time during the test"***, they should have performed tests to support their theory and submitted a code change to ICC with that substantiation.

Instead, a code consultant representing GBH International (fire test equipment & consulting services) is the one submitting this with no substantiation. That should be a huge red flag. You just don't delete a 55-year-old prescriptive test requirement without showing why the deletion is scientifically justified.

If you combine the total votes of both committees who heard these two proposals, there was a total of 13 votes to disapprove and 11 to approve. A historical review of the requirement for fire-retardant-treated wood may be helpful.

Requirements for Fire-retardant-treated wood first appeared in the 1964 UBC and required testing for 30 minutes in the "Tunnel Test", have a flame spread of not over 25 and show no evidence of progressive combustion.

Then, 24 years later, in the 1988 UBC, the 10.5 ft flame front limitation was added ***"To maintain the same level of performance of the material achieved under the previous flame spread calculation method."***

It is important to note that the 10.5 ft flame front limitation is evaluated during the 30-minute test whereas "progressive combustion" is evaluated at the end of the 30-minute test. Similar language is contained in the International Wildland Urban Interface Code for ignition-resistant building material (503.2, 1.1 & 503.2.1.2).

"1.1. Flame spread. Material shall exhibit a flame spread index not exceeding 25 and shall not show evidence of progressive combustion following the extended 30-minute test."

1.2. Flame front. Material shall exhibit a flame front that does not progress more than 10 ½ feet (3200 mm) beyond the centerline of the burner at any time during the extended 30-minute test."

The proponent has previously stated that he and others did not understand what was meant by "Significant progressive combustion" even though it's been in the code for 55 years.

"Combustion" is not defined in the IBC, the IFC or the IRC, but we all understand what constitutes combustion.

"Progressive" is what it means, combustion that progresses or continues following the 30-minute test.

"Significant", while subjective, appears 9 times in the IRC, 8 times in the IBC and 5 times in the IFC.

Keep in mind that ASTM E2768, where this all originated from with the claim that the prescriptive "**showing no evidence of significant progressive combustion**" is equivalent to the additional prescriptive requirement that "**the flame front shall not progress more than 10 ½ feet beyond the centerline of the burners at any time during the test**", has previously been disapproved in two previous code cycles and was not adopted by the Admin Committee during the current 2019 code cycle.

Overturing this proposal is necessary to be consistent with what the International Residential Code Committee-Building did when it unanimously voted (11-0) to disapprove the proposed deletion of significant progressive combustion (RB255-19) without scientific justification.

Overturing this proposal will maintain the current prescriptive requirements that Fire-retardant-treated wood as well as Ignition-resistant building materials must both show no evidence of significant progressive combustion (IBC 2303.2 and IWUIC 503.2).

Bibliography: No bibliography.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1895

S167-19

IBC: 2303.2.3, 2303.3.2.3.1 (New)

Proposed Change as Submitted

Proponents: Marcelo M Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Building Code

Revise as follows:

~~2303.2.3 Testing. For wood products produced by other means during manufacture, other than a pressure process, all sides fire retardant treated wood products the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section 2303.2. Wood structural panels shall be permitted to test only the front and back faces.~~

Add new text as follows:

2303.2.3.1 Fire testing of wood structural panels Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).

Reason: Note that the sections above require that fire retardant treated wood be "impregnated with chemicals" and provide permanent protection. That requirement applies to all FRTW products, whether produced by a pressure process or produced by other means during manufacture. Section 2303.2.2 is also explicit in stating that the use of paints or coatings is not an approved method to comply with this section. This proposal thus eliminates the requirement to test a particular type of fire retardant treated wood on "all sides", since the testing is never actually conducted on all sides (as pointed out often by multiple testifiers in previous code cycles) because all sides really means front and back (you literally cannot test the edges in the ASTM E84 other than by putting multiple edge pieces into the tunnel to make up the 24 feet by 2 feet specimen). In order to test "all sides" of a lumber product it would be necessary to fasten 864 small pieces together to make one specimen, which is not realistic. The proposed new subsection will add fire safety because it recognizes an issue that was highlighted in the previous code cycle, and was also brought up in committee ASTM E05 and at the IWUIC: wood structural panels are typically installed in the field following industry practice. Industry recommendations for wood structural panels require a gap to accommodate dimensional changes caused by swelling due to changing moisture conditions. Therefore, installation in the field requires cutting and ripping of the panels and this results in the creation of "non-factory edges". Therefore, it is important to test wood structural panels with a rip or gap to ensure that the required fire test results from the charging paragraph are achieved when the interior of the panel is exposed.

Note that the IWUIC requires such a rip or gap for ignition resistant structural panels, and it sends FRTW products to this IBC section.

Cost Impact: The code change proposal will increase the cost of construction

This proposal will add fire safety and will require more testing for wood structural panels. The proposal will also require more testing for other FRTW products manufactured by a pressure process but apparently less testing for FRTW products that are manufactured by other means, except that typically just the front and back faces are tested anyway.

S167-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

2018 International Building Code

~~2303.2.3 Testing. For fire retardant treated wood products the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section 2303.2.~~

~~2303.2.3.1 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).~~

Committee Reason: The proposed new subsection will add fire safety because it recognizes an issue that was highlighted in the previous code cycle, and was also brought up in committee ASTM E05 and at the IWUIC: wood structural panels are typically installed in the field following industry practice. The modification deletes unnecessary testing and therefore provides 'a level playing field'. (Vote: 11-3)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: 2303.2.3,

2303.2.3.1

(New)

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

2303.2.3 Testing. For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section 2303.2. Wood structural panels shall be permitted to test only the front and back faces.

2303.2.3.1

Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8".

Commenter's Reason: 2303.2.3 is necessary to ensure that products products products by methods that are not produced by a pressure process are equivalent to materials that are. It is needed to maintain life safety.

The 1/8" gap is representative of how the product is actually installed in the field.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Returning language to code.

Public Comment# 1689

Public Comment 2:

IBC@: 2303.2.3

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

2303.2.3 Fire Testing Of Wood Structural Panels Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8" (3.2 mm).

Commenter's Reason: The 1/8" gap is representative of how the product is installed and used in the field and products should be tested accordingly.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No cost impact, clarifying test conditions

Public Comment# 1694

Public Comment 3:

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests As Modified by Committee

Commenter's Reason: AWC supports the Committee-recommended modification. Section 2303.2 already addresses testing and performance requirements for FRTW produced either by a pressure process or by other means during manufacture, so the testing provisions of Section 2303.2.3 are redundant and unnecessary. Furthermore, the fact that Section 2303.2.3 is applicable only to FRTW produced by other means during manufacture creates a potential for double-standards when compared to the requirements for FRTW produced by a pressure process. Deletion of 2303.2.3 will remove these redundant provisions and help to ensure a 'level playing field' between FRTW product types.

With regards to the proposed new Section 2303.2.3.1, specific provisions regarding testing should be addressed in the applicable consensus-based test standard, rather than in the code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Testing provisions already addressed in code and therefore are redundant and unnecessary.

Public Comment# 1680

S174-19

IBC: TABLE 2304.10.1

Proposed Change as Submitted

Proponents: Rick Allen, International Staple, Nail and Tool Association, representing International Staple, Nail and Tool Association
(rallen@isanta.org)

2018 International Building Code

Revise as follows:

**TABLE 2304.10.1
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
Roof		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each end, toenail
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131") 2-3" x 0.131" nails 2-3" 14 gage staples	Each end, toenail
	2-16 d common (3½" x 0.162") 3-3" x 0.131" nails 3-3" 14 gage staples	End nail
Flat blocking to truss and web filler	16d common (3½" x 0.162") @ 6" o.c. 3" x 0.131" nails @ 6" o.c. 3" x 14 gage staples @ 6" o.c	Face nail
2. Ceiling joists to top plate	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown <u>Stainless Steel Fasteners are not applicable in this connection</u>	Each joist, toenail
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.7.3.1, Table 2308.7.3.1)	3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.7.3.1, Table 2308.7.3.1)	Per Table 2308.7.3.1	Face nail
5. Collar tie to rafter	3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
6. Rafter or roof truss to top plate (See Section 2308.7.5, Table 2308.7.5)	3-10 common (3" x 0.148"); or 3-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131 nails; or 4-3" 14 gage staples, 7/16" crown <u>Stainless Steel Fasteners are not applicable in this connection</u>	<u>2 toenails on one side and 1 toenail on opposite side of rafter or truss</u> [§] Toenail [®]
7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	2-16d common (3½" x 0.162"); or 3-16d box (3½" x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown; or	End nail
	3-10d common (3½" x 0.148"); or 4-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Toenail
Wall		
8. Stud to stud (not at braced wall panels)	16d common (3½" x 0.162");	24" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	16" o.c. face nail
9. Stud to stud and abutting studs at intersecting wallcorners (at braced wall panels)	16d common (3½" x 0.162"); or	16" o.c. face nail
	16d box (3½" x 0.135"); or	12" o.c. face nail
	3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	12" o.c. face nail
10. Built-up header (2" to 2" header)	16d common (3½" x 0.162"); or	16" o.c. each edge, face nail
	16d box (3½" x 0.135")	12" o.c. each edge, face nail
11. Continuous header to stud	4-8d common (2½" x 0.131"); or 4-10d box (3" x 0.128"); or 5-8d box (2½" x 0.113)	Toenail
12. Top plate to top plate	16d common (3½" x 0.162"); or	16" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail
13. Top plate to top plate, at end joints	8-16d common (3½" x 0.162"); or 12-16d box (3½" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails; or 12-3" 14 gage staples, 7/16" crown	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)

	Staples, 7/16" crown	Each side of end joint
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2" x 0.162"); or	16" o.c. face nail
	16d box (3 1/2" x 0.135"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	2-16d common (3 1/2" x 0.162"); or 3-16d box (3 1/2" x 0.135"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	16" o.c. face nail
16. Stud to top or bottom plate	3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-8d box (2 1/2" x 0.113"); or 4-3" 14 gage staples, 7/16" crown; or	Toenail
	2-16d common (3 1/2" x 0.162"); or 3-16d box (3 1/2" x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	End nail
17. Top plates, laps at corners and intersections	2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Face nail
18. 1" brace to each stud and plate	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Face nail
	<u>Stainless Steel Fasteners are not applicable in this connection</u>	
19. 1" x 6" sheathing to each bearing	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-1 3/4" 16 gage staples, 1" crown	Face nail
	<u>Stainless Steel Fasteners are not applicable in this connection</u>	
20. 1" x 8" and wider sheathing to each bearing	3-8d common (2 1/2" x 0.131"); or 3-8d box (2 1/2" x 0.113"); or 3-2-10d box (3" x 0.128"); or 3-1 3/4" 16 gage staples, 1" crown	Face nail
	<u>Stainless Steel Fasteners are not applicable in this connection</u>	
	Wider than 1" x 8" 3-8d common (2 1/2" x 0.131"); or 4-8d box (2 1/2" x 0.113"); or 3-10d box (3" x 0.128"); or 4-1 3/4" 16 gage staples, 1" crown	
	<u>Stainless Steel Fasteners are not applicable in this connection</u>	
Floor		
21. Joist to sill, top plate, or girder	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or floor 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Toenail
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	4-8d box (2 1/2" x 0.113)	4" o.c. toenail
	8d common (2 1/2" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	6" o.c., toenail
23. 1" x 6" subfloor or less to each joist	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-3-10d box (3" x 0.128"); or 2-1 3/4" 16 gage staples 1" crown	Face nail
	<u>Stainless Steel Fasteners are not applicable in this connection</u>	
24. 2 subfloor to joist or girder	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	Blind and Face nail
25. 2" planks (plank & beam – floor & roof)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	Each bearing, face nail
26. Built-up girders and beams, 2" lumber layers	20d common (4" x 0.192")	32" o.c., face nail at top and bottom staggered on opposite sides
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	24" o.c. face nail at top and bottom staggered on opposite sides
	And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Ends and at each splice, face nail

27. Ledger strip supporting joists or rafters	3-16d common (3 1/2" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Each joist or rafter, face nail	
28. Joist to band joist or rim joist	3-16d common (3 1/2" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	End nail	
29. Bridging or blocking to joist, rafter or truss	2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Each end, toenail	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
30. 3/8" - 1/2"	6d common or deformed (2" x 0.113"); or 2 3/8" x 0.113" nail (subfloor and wall)	6	12
	8d common or deformed (2 1/2" x 0.131") (roof) or RSRS-01 (2 3/8" x 0.113") nail (roof) ^d	6	12
	2 3/8" x 0.113" nail (subfloor and wall)	6	12
	1 3/4" 16 gage staple, 7/16" crown (subfloor and wall)	4	8
	2 3/8" x 0.113" nail (roof)	4	8
	1 3/4" 16 gage staple, 7/16" crown (roof)	3	6
31. 19/32" - 3/4"	8d common (2 1/2" x 0.131"); or 6d deformed (2" x 0.113") (subfloor and wall)	6	12
	8d common or deformed (2 1/2" x 0.131") (roof) or RSRS-01 (2 3/8" x 0.113") nail (roof) ^d	6	12
	2 3/8" x 0.113" nail; or 2" 16 gage staple, 7/16" crown	4	8
32. 7/8" - 1 1/4"	10d common (3" x 0.148"); or 8d deformed (2 1/2" x 0.131")	6	12
Other exterior wall sheathing			
33. 1/2" fiberboard sheathing ^b	1 1/2" x 0.120" galvanized roofing nail (7/16" head diameter); or 1 1/4" 16 gage staple with 7/16" or 1" crown	3	6
34. 25/32" fiberboard sheathing ^b	1 3/4" x 0.120" galvanized roofing nail (7/16" diameter head); or 1 1/2" 16 gage staple with 7/16" or 1" crown	3	6
Wood structural panels, combination subfloor underlayment to framing			
35. 3/4" and less	8d common (2 1/2" x 0.131"); or 6d deformed (2" x 0.113") or deformed 2" x 0.120"	6	12
36. 7/8" - 1"	8d common (2 1/2" x 0.131"); or 8d deformed (2 1/2" x 0.131"); or deformed 2 1/2" x 0.120"	6	12
37. 1 1/8" - 1 1/4"	10d common (3" x 0.148"); or 8d deformed (2 1/2" x 0.131"); or deformed 2 1/2" x 0.120"	6	12
Panel siding to framing			
38. 1/2" or less	6d corrosion-resistant siding (1 7/8" x 0.106"); or 6d corrosion-resistant casing (2" x 0.099")	6	12
39. 5/8"	8d corrosion-resistant siding (2 3/8" x 0.128"); or 8d corrosion-resistant casing (2 1/2" x 0.113")	6	12
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
Interior paneling			
40. 1/4"	4d casing (1 1/2" x 0.080"); or 4d finish (1 1/2" x 0.072")	6	12
41. 3/8"	6d casing (2" x 0.099"); or 6d finish (2" x 0.092") (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

- a. Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
- b. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- c. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
- d. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Reason: IBC Table 2304.10.1 and IRC Table R602.3(1) are essentially the same table in structural connections 1 through 39. Although the descriptions are closely align, there are fasteners prescribed in the IBC table that are not in the IRC table and fasteners prescribed in the IRC table that are not in the IBC table.

This proposal is written to harmonize the fasteners between the two tables. In addition, where additional information exists in one table and not the other, this too is being harmonized.

For connections # 2,6,18,19, 20 & 23 there was a code change proposal RB272-13 entered in by the American Wood Council and adopted for the 2015 IRC. The reference nail values for the nailing schedule in these connections were based on Reference Lateral Values and Reference Withdrawal values. All other connections in the table were based on Reference Lateral Design Values. In the 2018 NDS, the reference withdrawal values for stainless steel nails were tabulated in a new NDS table (12.2D). The withdrawal values for stainless steel are lower than the values for carbon steel (bright or galvanized) nails of equivalent diameters.

As such, the lower stainless steel withdrawal values combined with the publication date of the 2018 NDS and the 2015 code proposal date would indicate that the basis of the original code proposal is relevant to only carbon steel nails and not to stainless steel nails. The added note to these connections is to exclude stainless steel from these connections based on the lower withdrawal values.

Connection 1:

Added 8d box nails to match IRC R602.3(1)

Connection 2:

Added note regarding stainless steel fasteners

Added 8d box nails from IRC R602.3(1)

Connection 6:

Added note regarding stainless steel fasteners

Changed Fastener Spacing and Location note to match IRC R602.3(1)

Connection 7:

Added 16d Box nails to match IRC R602.3(1)

Connection 11

Added 8d Box nails to match IRC R602.3(1)

Connection 13

Added 16d Box nails to match IRC R602.3(1)

Connection 16

Added 16d Box and 8d Box nails to match IRC R602.3(1)

Connection 18

Added note regarding stainless steel fasteners

Added 8d Box nails to match IRC R602.3(1)

Connection 19

Added note regarding stainless steel fasteners

Added 8d Box nails to match IRC R602.3(1)

Added 16 gage staples to match IRC R602.3(1)

Connection 20

Added note regarding stainless steel fasteners

Added 8d Box nails to match IRC R602.3(1)

Added 16 gage staples to match IRC R602.3(1)

Added subcategory "wider than 1" x 8" to match IRC R602.3(1)

Connection 21

Added 8d Box nails to match IRC R602.3(1)

Connection 22

Added a subcategory of 4' o.c. to match IRC R602.3(1)

Connection 23

Added note regarding stainless steel fasteners

Added 8d Box nails to match IRC R602.3(1)

Added 16 gage staples to match IRC R602.3(1)

Connection 24

Added 16d box nails to match IRC R602.3(1)

Changed Spacing and Location notation to match IRC R602.3(1)

Connection 25

Added 16d box nails to match IRC R602.3(1)

Connection 27

Added 16d box nails to match IRC R602.3(1)

Connection 30:

All 6 and 12 subfloor and wall fasteners were moved into one line

Connection 31:

The description **6d deformed (2" x 0.113")** is an incorrect description. ASTM F1667 does not have a classification for 6d deformed nails. The correct description is deformed (2" x 0.113")

Connection 32:

The description **8d deformed (2" x 0.131")** is an incorrect description. ASTM F1667 does not have a classification for 8d deformed nails. The correct description is deformed (2½" x 0.131")

Connections 33 & 34:

The current nail description is incomplete and is missing a shank diameter. Addition of the diameters match AWC SDPWS

Connections 35:

The description **6d deformed (2" x 0.113")** is an incorrect description. ASTM F1667 does not have a classification for 6d deformed nails. The correct description is deformed (2" x 0.113")

Connection 36 & 37:

The description **8d deformed (2" x 0.131")** is an incorrect description. ASTM F1667 does not have a classification for 8d deformed nails. The correct description is deformed (2½" x 0.131")

Connection 41:

Dimension of a 6d finish nail has been added to be consistent

Cost Impact: The code change proposal will not increase or decrease the cost of construction listing of additional fasteners should have no effect on cost of construction

S174-19

Public Hearing Results

Committee Action:**As Modified**

Committee Modification:
2018 International Building Code

TABLE 2304.10.1**FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^e	SPACING AND LOCATION
Roof		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each end, toenail
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131") 2-3" x 0.131" nails 2-3" 14 gage staples	Each end, toenail
	2-16d common (3½" x 0.162") 3-3" x 0.131" nails 3-3" 14 gage staples	End nail
Flat blocking to truss and web filler	16d common (3½" x 0.162") @ 6 o.c. 3" x 0.131" nails @ 6 o.c. 3" 14 gage staples @ 6 o.c	Face nail
2. Ceiling joists to top plate	4-8d box (2½" x 0.113") 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown Stainless Steel Fasteners are no applicable in this connection	Each joist, toenail
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.7.3.1, Table 2308.7.3.1)	3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.7.3.1, Table 2308.7.3.1)	Per Table 2308.7.3.1	Face nail

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
5. Collar tie to rafter	3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
6. Rafter or roof truss to top plate (See Section 2308.7.5, Table 2308.7.5)	3-10 common (3" x 0.148"); or 3-16d box (3 1/2" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown Stainless Steel Fasteners are not applicable in this connection	2 toenails on one side and 1 toenail on opposite side of rafter or truss ^c
7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	2-16d common (3 1/2" x 0.162"); or 3-16d box (3 1/2" x 0.135") or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	End nail
	3-16d common (3 1/2" x 0.148"); or 4-16d box (3 1/2" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Toenail
Wall		
8. Stud to stud (not at braced wall panels)	16d common (3 1/2" x 0.162");	24 o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	16 o.c. face nail
9. Stud to stud and abutting studs at intersecting wallcorners (at braced wall panels)	16d common (3 1/2" x 0.162"); or	16 o.c. face nail
	16d box (3 1/2" x 0.135"); or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	12 o.c. face nail
	3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	12 o.c. face nail
10. Built-up header (2 to 2 header)	16d common (3 1/2" x 0.162"); or	16 o.c. each edge, face nail
	16d box (3 1/2" x 0.135")	12 o.c. each edge, face nail
11. Continuous header to stud	4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 5-8d box (2 1/2" x 0.113")	Toenail
12. Top plate to top plate	16d common (3 1/2" x 0.162"); or	16 o.c. face nail
	10d box (3" x 0.128"); or 3" 0.131" nails; or 3" 14 gage staples, 7/16" crown	12 o.c. face nail
13. Top plate to top plate, at end joints	8-16d common (3 1/2" x 0.162"); or 12-16d box 3 1/2" x 0.135"); or 12-10d box (3" x 0.128); or 12-3" x 0.131 nails; or 12-3" 14 gage staples, 7/16" crown	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2" x 0.162"); or	16 o.c. face nail
	16d box (3 1/2" x 0.135"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12 o.c. face nail
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	2-16d common (3 1/2" x 0.162"); or 3-16d box (3 1/2" x 0.135); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	16 o.c. face nail
16. Stud to top or bottom plate	3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131"; or 4-8d box (2 1/2" x 0.113" nails; or 4-3" 14 gage staples, 7/16" crown	Toenail
	2-16d common (3 1/2" x 0.162"); or 3-16d box 3 1/2" x 0.135"; or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	End nail
17. Top plates, laps at corners and intersections	2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Face nail
18. 1 brace to each stud and plate	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Face nail
	Stainless Steel Fasteners are not applicable in this connection	
19. 1 6 sheathing to each bearing	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2-1 3/4" 16 gage staples, 1" crown	Face nail
	Stainless Steel Fasteners are not applicable in this connection	

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION	
20. 1 8 and wider sheathing to each bearing	3-8d common (2½" x 0.131"); or 3-8d box (2½" x 0.113"); or 3-2-10d box (3" x 0.128") or 3-1¾" 16 gage staples, 1" crown Stainless Steel Fasteners are not applicable in this connection	Face nail	
	Wider than 1" x 8" 3-8d common (2½" x 0.131"); or 4-8d box (2½" x 0.113"); or 3-10d box (3" x 0.128"); or 4-1¾" 16 gage staples, 1" crown Stainless Steel Fasteners are not applicable in this connection		
Floor			
21. Joist to sill, top plate, or girder	4 8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or floor 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Toenail	
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	4-8d box (2½" x 0.113")	4" o.c. toenail	
	8d common (2½" x 0.131); or 10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	6 o.c., toenail	
23. 1 6 subfloor or less to each joist	3-8d box (2½" x 0.113") or 2-8d common (2½" x 0.131); or 3-10d box (3" x 0.128"); or 2-1¾" 16 gage staples 1" crown Stainless Steel Fasteners are not applicable in this connection	Face nail	
24. 2 subfloor to joist or girder	3-16d box (3½" x 0.135"); or 2-16d common (3½" x 0.162")	Blind and Face nail	
25. 2 planks (plank & beam floor & roof)	3-16d box (3½" x 0.135"); or 2-16d common (3½" x 0.162")	Each bearing, face nail	
26. Built-up girders and beams, 2 lumber layers	20d common (4" x 0.192")	32 o.c., face nail at top and bottom staggered on opposite sides	
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	24 o.c. face nail at top and bottom staggered on opposite sides	
	And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Ends and at each splice, face nail	
27. Ledger strip supporting joists or rafters	3-16d common (3½" x 0.162"); or 4-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Each joist or rafter, face nail	
28. Joist to band joist or rim joist	3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	End nail	
29. Bridging or blocking to joist, rafter or truss	2-8d common (2½" x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Each end, toenail	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing^a			
		Edges (inches)	Intermediate supports (inches)
30. 3/8 1/2	6d common or deformed (2" x 0.113"); or 2³/8" x 0.113" (subfloor and wall)	6	12
	8d common or deformed (2½" x 0.131" x 0.281" head) (roof) or RSRS-01 (2³/8" x 0.113") nail (roof) ^d		
	1¾" 16 gage staple, 7/16" crown (subfloor and wall)	4	8
	2³/8" x 0.113" x 0.266" head nail (roof)	4	8
	1¾" 16 gage staple, 7/16" crown (roof)	3	6
	8d common (2½" x 0.131"); or deformed (2" x 0.113") (subfloor and wall)	6	12

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION	
	8d common or deformed (2 ¹ / ₂ " x 0.131" x 0.281" head) (roof) or RSRS-01 (2 ³ / ₈ " x 0.113") nail (roof) ^d	6	12
	2 ³ / ₈ " x 0.113" x 0.266" head nail; or 2" 16 gage staple, 7/16" crown	4	8
32. 7/8 1 ¹ / ₄	10d common (3" x 0.148"); or deformed (2 ¹ / ₂ " x 0.131" x 0.281" head)	6	12
Other exterior wall sheathing			
33. 1/2 fiberboard sheathing ^b	1 ¹ / ₂ x 0.120" galvanized roofing nail (7/16" head diameter); or 1 ¹ / ₄ " 16 gage staple with 7/16" or 1" crown	3	6
34. 25/32 fiberboard sheathing ^b	1 ³ / ₄ " x 0.120" galvanized roofing nail (7/16" diameter head); or 1 ¹ / ₂ " 16 gage staple with 7/16" or 1" crown	3	6
Wood structural panels, combination subfloor underlayment to framing			
35. 3/4 and less	8d common (2 ¹ / ₂ " x 0.131"); or deformed (2" x 0.113"); or deformed 2" x 0.120"	6	12
36. 7/8 1	8d common (2 ¹ / ₂ " x 0.131"); or deformed (2 ¹ / ₂ " x 0.131")	6	12
37. 1 ¹ / ₈ 1 ¹ / ₄	10d common (3" x 0.148"); or deformed (2 ¹ / ₂ " x 0.131"); or deformed 2 ¹ / ₂ " x 0.120"	6	12
Panel siding to framing			
38. 1/2 or less	6d corrosion-resistant siding (1 ⁷ / ₈ " x 0.106"); or 6d corrosion-resistant casing (2" x 0.099")	6	12
39. 5/8	8d corrosion-resistant siding (2 ³ / ₈ " x 0.128"); or 8d corrosion-resistant casing (2 ¹ / ₂ " x 0.113")	6	12
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing^a			
		Edges (inches)	Intermediate supports (inches)
Interior paneling			
40. 1/4	4d casing (1 ¹ / ₂ " x 0.080); or 4d finish (1 ¹ / ₂ " x 0.072")	6	12
41. 3/8	6d casing (2" x 0.099"); or 6d finish 2" x 0.092" (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

a. Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.

b. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).

c. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.

d. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

e. Nails and staples are carbon steel meeting the specifications of ASTM F1667

Committee Reason: This proposal harmonizes the IBC table with the IRC table. The modification provided coordination with the latest NDS standard (especially for stainless steel fasteners) (Vote: 14-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IBC@: TABLE 2304.10.1 (New)

Proponents:

Kelly Cobeen, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

**TABLE 2304.10.1
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER _e	SPACING AND LOCATION
Roof		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each end, toenail
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131") 2-3" x 0.131" nails 2-3" 14 gage staples	Each end, toenail
	2-16 d common (3½" x 0.162") 3-3" x 0.131" nails 3-3" 14 gage staples	End nail
Flat blocking to truss and web filler	16d common (3½" x 0.162") @ 6" o.c. 3" x 0.131" nails @ 6" o.c. 3" x 14 gage staples @ 6" o.c	Face nail
2. Ceiling joists to top plate	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each joist, toenail
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.7.3.1, Table 2308.7.3.1)	3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.7.3.1, Table 2308.7.3.1)	Per Table 2308.7.3.1	Face nail
5. Collar tie to rafter	3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
6. Rafter or roof truss to top plate (See Section 2308.7.5, Table 2308.7.5)	3-10 common (3" x 0.148"); or 3-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131 nails; or 4-3" 14 gage staples, 7/16" crown	2 toenails on one side and 1 toenail on opposite side of rafter or truss ^c
7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	2-16d common (3½" x 0.162"); or 3-16d box (3½" x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown; or	End nail
	3-10d common (3½" x 0.148"); or 4-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Toenail
Wall		
8. Stud to stud (not at braced wall panels)	16d common (3½" x 0.162");	24" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	16" o.c. face nail
9. Stud to stud and abutting studs at intersecting wallcorners (at braced wall panels)	16d common (3½" x 0.162")	16" o.c. face nail
	16d box (3½" x 0.135"); or	12" o.c. face nail or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown
10. Built-up header (2" to 2" header)	16d common (3½" x 0.162")	16" o.c. each edge, face nail
	16d box (3½" x 0.135")	12" o.c. each edge, face nail
11. Continuous header to stud	4-8d common (2½" x 0.131"); or 4-10d box (3" x 0.128"); or 5-8d box (2½" x 0.113)	Toenail
12. Top plate to top plate	16d common (3½" x 0.162")	16" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail
13. Top plate to top plate, at end joints	8-16d common (3½" x 0.162"); or 12-16d box (3½" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails; or 12-3" 14 gage staples, 7/16" crown	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3½" x 0.162")	16" o.c. face nail
	16d box (3½" x 0.135"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail

	$\frac{1}{16}$ " crown		
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-16d box ($3\frac{1}{2}$ " x 0.135"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, $\frac{7}{16}$ " crown	16" o.c. face nail	
16. Stud to top or bottom plate	3-16d box ($3\frac{1}{2}$ " x 0.135"); or 4-8d common ($2\frac{1}{2}$ " x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-8d box ($2\frac{1}{2}$ " x 0.113"); or 4-3" 14 gage staples, $\frac{7}{16}$ " crown; or	Toenail	
	2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-16d box ($3\frac{1}{2}$ " x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	End nail	
17. Top plates, laps at corners and intersections	2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	Face nail	
18. 1" brace to each stud and plate	3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, $\frac{7}{16}$ " crown	Face nail	
19. 1" x 6" sheathing to each bearing	3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-10d box (3" x 0.128"); or 2-1 $\frac{3}{4}$ " 16 gage staples, 1" crown	Face nail	
20. 1" x 8" and wider sheathing to each bearing	3-8d common ($2\frac{1}{2}$ " x 0.131"); or 3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-10d box (3" x 0.128"); or 3-1 $\frac{3}{4}$ " 16 gage staples, 1" crown	Face nail	
	Wider than 1" x 8"		
	3-8d common ($2\frac{1}{2}$ " x 0.131"); or 4-8d box ($2\frac{1}{2}$ " x 0.113"); or 3-10d box (3" x 0.128"); or 4-1 $\frac{3}{4}$ " 16 gage staples, 1" crown		
Floor			
21. Joist to sill, top plate, or girder	4-8d box ($2\frac{1}{2}$ " x 0.113"); or 3-8d common ($2\frac{1}{2}$ " x 0.131"); or floor 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	Toenail	
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	4-8d box ($2\frac{1}{2}$ " x 0.113)	4" o.c. toenail	
	8d common ($2\frac{1}{2}$ " x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, $\frac{7}{16}$ " crown	6" o.c., toenail	
23. 1" x 6" subfloor or less to each joist	3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 3-10d box (3" x 0.128"); or 2-1 $\frac{3}{4}$ " 16 gage staples 1" crown	Face nail	
24. 2 subfloor to joist or girder	3-16d box ($3\frac{1}{2}$ " x 0.135"); or 2-16d common ($3\frac{1}{2}$ " x 0.162")	Blind and Face nail	
25. 2" planks (plank & beam – floor & roof)	3-16d box ($3\frac{1}{2}$ " x 0.135"); or 2-16d common ($3\frac{1}{2}$ " x 0.162")	Each bearing, face nail	
26. Built-up girders and beams, 2" lumber layers	20d common (4" x 0.192")	32" o.c., face nail at top and bottom staggered on opposite sides	
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, $\frac{7}{16}$ " crown	24" o.c. face nail at top and bottom staggered on opposite sides	
	And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	Ends and at each splice, face nail	
27. Ledger strip supporting joists or rafters	3-16d common ($3\frac{1}{2}$ " x 0.162"); or 4-16d box ($3\frac{1}{2}$ " x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, $\frac{7}{16}$ " crown	Each joist or rafter, face nail	
28. Joist to band joist or rim joist	3-16d common ($3\frac{1}{2}$ " x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, $\frac{7}{16}$ " crown	End nail	
29. Bridging or blocking to joist, rafter or truss	2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, $\frac{7}{16}$ " crown	Each end, toenail	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
	6d common or deformed (2" x 0.113"); or 2 $\frac{3}{8}$ " x 0.113" nail	6	12

	(subfloor and wall)		
30. $\frac{3}{8}$ " – $\frac{1}{2}$ "	8d common or deformed ($2\frac{1}{2}$ " x 0.131") (roof) or RSRS-01		
	$1\frac{3}{4}$ " 16 gage staple, $\frac{7}{16}$ " crown (subfloor and wall)	4	8
	$2\frac{3}{8}$ " x 0.113" nail (roof)	4	8
	$1\frac{3}{4}$ " 16 gage staple, $\frac{7}{16}$ " crown (roof)	3	6
31. $\frac{19}{32}$ " – $\frac{3}{4}$ "	8d common ($2\frac{1}{2}$ " x 0.131"); or deformed (2" x 0.113") (subfloor and wall)	6	12
	8d common or deformed ($2\frac{1}{2}$ " x 0.131" x 0.281" head) (roof) or RSRS-01 ($2\frac{3}{8}$ " x 0.113") nail (roof)d	6	12
	$2\frac{3}{8}$ " x 0.113" x 0.266" head nail; or 2" 16 gage staple, $\frac{7}{16}$ " crown	4	8
32. $\frac{7}{8}$ " – $1\frac{1}{4}$ "	10d common (3" x 0.148"); or deformed ($2\frac{1}{2}$ " x 0.131" x 0.281" head)	6	12
Other exterior wall sheathing			
33. $\frac{1}{2}$ " fiberboard sheathing ^b	$1\frac{1}{2}$ " x 0.120", galvanized roofing nail ($\frac{7}{16}$ " head diameter); or $1\frac{1}{4}$ " 16 gage staple with $\frac{7}{16}$ " or 1" crown	3	6
34. $\frac{25}{32}$ " fiberboard sheathing ^b	$1\frac{3}{4}$ " x 0.120" galvanized roofing nail ($\frac{7}{16}$ " diameter head); or $1\frac{1}{2}$ " 16 gage staple with $\frac{7}{16}$ " or 1" crown	3	6
Wood structural panels, combination subfloor underlayment to framing			
35. $\frac{3}{4}$ " and less	8d common ($2\frac{1}{2}$ " x 0.131"); or deformed (2" x 0.113") or deformed 2" x 0.120"	6	12
36. $\frac{7}{8}$ " – 1"	8d common ($2\frac{1}{2}$ " x 0.131"); or deformed ($2\frac{1}{2}$ " x 0.131"); or deformed $2\frac{1}{2}$ " x 0.120"	6	12
37. $1\frac{1}{8}$ " – $1\frac{1}{4}$ "	10d common (3" x 0.148"); or deformed ($2\frac{1}{2}$ " x 0.131"); or deformed $2\frac{1}{2}$ " x 0.120"	6	12
Panel siding to framing			
38. $\frac{1}{2}$ " or less	6d corrosion-resistant siding ($1\frac{7}{8}$ " x 0.106"); or 6d corrosion-resistant casing (2" x 0.099")	6	12
39. $\frac{5}{8}$ "	8d corrosion-resistant siding ($2\frac{3}{8}$ " x 0.128"); or 8d corrosion-resistant casing ($2\frac{1}{2}$ " x 0.113")	6	12
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
Interior paneling			
40. $\frac{1}{4}$ "	4d casing ($1\frac{1}{2}$ " x 0.080"); or 4d finish ($1\frac{1}{2}$ " x 0.072")	6	12
41. $\frac{3}{8}$ "	6d casing (2" x 0.099"); or 6d finish (2" x 0.092") (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

- Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
- Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
- RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.
- Nails and staples are carbon steel meeting the specifications of ASTM F1667. Connections using nails and staples of other materials or dimensions, such as stainless steel, shall be designed by accepted engineering practice or approved under Section 104.11.

Commenter's Reason: This public comment adds language to new footnote e in order to further clarify that the code change proposal, as approved at the CAH, deletes stainless steel nails and staples from this table. The added language is proposed because it is feared that users of the code will easily miss this change, and not necessarily understand that stainless steel is not carbon steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment provides clarification of provisions only.

Public Comment# 1807

Public Comment 2:

IBC®: TABLE 2304.10.1 (New)

Proponents:

J Daniel Dolan, representing Federal Emergency Management Agency/ Applied Technology Council Seismic Codes Support Committee
(jddolan@wsu.edu)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

**TABLE 2304.10.1
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
Roof		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each end, toenail
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131") 2-3" x 0.131" nails 2-3" 14 gage staples	Each end, toenail
	2-16 d common (3½" x 0.162") 3-3" x 0.131" nails 3-3" 14 gage staples	End nail
Flat blocking to truss and web filler	16d common (3½" x 0.162") @ 6" o.c. 3" x 0.131" nails @ 6" o.c. 3" x 14 gage staples @ 6" o.c	Face nail
2. Ceiling joists to top plate	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each joist, toenail
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.7.3.1, Table 2308.7.3.1)	3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.7.3.1, Table 2308.7.3.1)	Per Table 2308.7.3.1	Face nail
5. Collar tie to rafter	3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
6. Rafter or roof truss to top plate (See Section 2308.7.5, Table 2308.7.5)	3-10 common (3" x 0.148"); or 3-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131 nails; or 4-3" 14 gage staples, 7/16" crown	2 toenails on one side and 1 toenail on opposite side of rafter or truss ^c
7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	2-16d common (3½" x 0.162"); or 3-16d box (3½" x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown; or	End nail
	3-10d common (3½" x 0.148"); or 4-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Toenail
Wall		
8. Stud to stud (not at braced wall panels)	16d common (3½" x 0.162");	24" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	16" o.c. face nail
9. Stud to stud and abutting studs at intersecting wallcorners (at braced wall panels)	16d common (3½" x 0.162")	16" o.c. face nail
	16d box (3½" x 0.135"); or	12" o.c. face nail or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown
10. Built-up header (2" to 2" header)	16d common (3½" x 0.162")	16" o.c. each edge, face nail
	16d box (3½" x 0.135")	12" o.c. each edge, face nail
11. Continuous header to stud	4-8d common (2½" x 0.131"); or 4-10d box (3" x 0.128"); or 5-8d box (2½" x 0.113)	Toenail
12. Top plate to top plate	16d common (3½" x 0.162")	16" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail
13. Top plate to top plate, at end joints	8-16d common (3½" x 0.162"); or 12-16d box (3½" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails; or 12-3" 14 gage staples, 7/16" crown	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3½" x 0.162")	16" o.c. face nail
	16d box (3½" x 0.135"); or 3" x 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail

	$\frac{1}{16}$ " crown		
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-16d box ($3\frac{1}{2}$ " x 0.135"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, $\frac{7}{16}$ " crown	16" o.c. face nail	
16. Stud to top or bottom plate	3-16d box ($3\frac{1}{2}$ " x 0.135"); or 4-8d common ($2\frac{1}{2}$ " x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-8d box ($2\frac{1}{2}$ " x 0.113"); or 4-3" 14 gage staples, $\frac{7}{16}$ " crown; or	Toenail	
	2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-16d box ($3\frac{1}{2}$ " x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	End nail	
17. Top plates, laps at corners and intersections	2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	Face nail	
18. 1" brace to each stud and plate	3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, $\frac{7}{16}$ " crown	Face nail	
19. 1" x 6" sheathing to each bearing	3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-10d box (3" x 0.128"); or 2-1 $\frac{3}{4}$ " 16 gage staples, 1" crown	Face nail	
20. 1" x 8" and wider sheathing to each bearing	3-8d common ($2\frac{1}{2}$ " x 0.131"); or 3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-10d box (3" x 0.128"); or 3-1 $\frac{3}{4}$ " 16 gage staples, 1" crown	Face nail	
	Wider than 1" x 8"		
	3-8d common ($2\frac{1}{2}$ " x 0.131"); or 4-8d box ($2\frac{1}{2}$ " x 0.113"); or 3-10d box (3" x 0.128"); or 4-1 $\frac{3}{4}$ " 16 gage staples, 1" crown Stainless Steel Fasteners are not applicable in this connection		
Floor			
21. Joist to sill, top plate, or girder	4-8d box ($2\frac{1}{2}$ " x 0.113"); or 3-8d common ($2\frac{1}{2}$ " x 0.131"); or floor 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	Toenail	
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	4-8d box ($2\frac{1}{2}$ " x 0.113)	4" o.c. toenail	
	8d common ($2\frac{1}{2}$ " x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, $\frac{7}{16}$ " crown	6" o.c., toenail	
23. 1" x 6" subfloor or less to each joist	3-8d box ($2\frac{1}{2}$ " x 0.113"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 3-10d box (3" x 0.128"); or 2-1 $\frac{3}{4}$ " 16 gage staples 1" crown	Face nail	
24. 2 subfloor to joist or girder	3-16d box ($3\frac{1}{2}$ " x 0.135"); or 2-16d common ($3\frac{1}{2}$ " x 0.162")	Blind and Face nail	
25. 2" planks (plank & beam – floor & roof)	3-16d box ($3\frac{1}{2}$ " x 0.135"); or 2-16d common ($3\frac{1}{2}$ " x 0.162")	Each bearing, face nail	
26. Built-up girders and beams, 2" lumber layers	20d common (4" x 0.192")	32" o.c., face nail at top and bottom staggered on opposite sides	
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples, $\frac{7}{16}$ " crown	24" o.c. face nail at top and bottom staggered on opposite sides	
	And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, $\frac{7}{16}$ " crown	Ends and at each splice, face nail	
27. Ledger strip supporting joists or rafters	3-16d common ($3\frac{1}{2}$ " x 0.162"); or 4-16d box ($3\frac{1}{2}$ " x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, $\frac{7}{16}$ " crown	Each joist or rafter, face nail	
28. Joist to band joist or rim joist	3-16d common ($3\frac{1}{2}$ " x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, $\frac{7}{16}$ " crown	End nail	
29. Bridging or blocking to joist, rafter or truss	2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-10d box (3" x 0.128"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples, $\frac{7}{16}$ " crown	Each end, toenail	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
	6d common or deformed (2" x 0.113"); or 2 $\frac{3}{8}$ " x 0.113" nail	6	12

	(subfloor and wall)		
30. $\frac{3}{8}$ " – $\frac{1}{2}$ "	8d common or deformed ($2\frac{1}{2}$ " x 0.131") (roof) or RSRS-01		
	$1\frac{3}{4}$ " 16 gage staple, $\frac{7}{16}$ " crown (subfloor and wall)	4	8
	$2\frac{3}{8}$ " x 0.113" nail (roof)	4	8
	$1\frac{3}{4}$ " 16 gage staple, $\frac{7}{16}$ " crown (roof)	3	6
31. $\frac{19}{32}$ " – $\frac{3}{4}$ "	8d common ($2\frac{1}{2}$ " x 0.131"); or deformed (2 " x 0.113") (subfloor and wall)	6	12
	8d common or deformed ($2\frac{1}{2}$ " x 0.131" x 0.281" head) (roof) or RSRS-01 ($2\frac{3}{8}$ " x 0.113") nail (roof)d	6	12
	$2\frac{3}{8}$ " x 0.113" x 0.266" head nail; or 2" 16 gage staple, $\frac{7}{16}$ " crown	4	8
32. $\frac{7}{8}$ " – $1\frac{1}{4}$ "	10d common (3 " x 0.148"); or deformed ($2\frac{1}{2}$ " x 0.131" x 0.281" head)	6	12
Other exterior wall sheathing			
33. $\frac{1}{2}$ " fiberboard sheathing ^b	$1\frac{1}{2}$ " x 0.120", galvanized roofing nail ($\frac{7}{16}$ " head diameter); or $1\frac{1}{4}$ " 16 gage staple with $\frac{7}{16}$ " or 1" crown	3	6
34. $\frac{25}{32}$ " fiberboard sheathing ^b	$1\frac{3}{4}$ " x 0.120" galvanized roofing nail ($\frac{7}{16}$ " diameter head); or $1\frac{1}{2}$ " 16 gage staple with $\frac{7}{16}$ " or 1" crown	3	6
Wood structural panels, combination subfloor underlayment to framing			
35. $\frac{3}{4}$ " and less	8d common ($2\frac{1}{2}$ " x 0.131"); or deformed (2 " x 0.113") or deformed 2 " x 0.120"	6	12
36. $\frac{7}{8}$ " – 1 "	8d common ($2\frac{1}{2}$ " x 0.131"); or deformed ($2\frac{1}{2}$ " x 0.131"); or deformed $2\frac{1}{2}$ " x 0.120"	6	12
37. $1\frac{1}{8}$ " – $1\frac{1}{4}$ "	10d common (3 " x 0.148"); or deformed ($2\frac{1}{2}$ " x 0.131"); or deformed $2\frac{1}{2}$ " x 0.120"	6	12
Panel siding to framing			
38. $\frac{1}{2}$ " or less	6d corrosion-resistant siding ($1\frac{7}{8}$ " x 0.106"); or 6d corrosion-resistant casing (2 " x 0.099")	6	12
39. $\frac{5}{8}$ "	8d corrosion-resistant siding ($2\frac{3}{8}$ " x 0.128"); or 8d corrosion-resistant casing ($2\frac{1}{2}$ " x 0.113")	6	12
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
Interior paneling			
40. $\frac{1}{4}$ "	4d casing ($1\frac{1}{2}$ " x 0.080"); or 4d finish ($1\frac{1}{2}$ " x 0.072")	6	12
41. $\frac{3}{8}$ "	6d casing (2 " x 0.099"); or 6d finish (2 " x 0.092") (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

- Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
- Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
- RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.
- Nails and staples are carbon steel meeting the specifications of ASTM F1667. Connections using nails and staples of other materials, such as stainless steel, shall be designed by acceptable engineering practice or approved under Section 104.11.

Commenter's Reason: This public comment adds language to a new footnote e in order to clarify that the code change proposal, as approved at the CAH, deleted stainless steel nails and staples from this table. The added language is proposed because it is feared that users of the code will easily miss this change, and not necessarily understand that stainless steel is not carbon steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed comment does not add additional requirements, but rather clarifies that stainless steel (and other materials) required different considerations due to the differences in strength and withdrawal characteristics. Since stainless steel is being deleted in the approval in the CAH, this comment only provides clarification and does not add any cost effects to what is already accepted.

Public Comment# 1804

S187-19

IBC®: TABLE 2308.7.3.1

Proposed Change as Submitted

Proponents: Dennis Richardson, American Wood Council, representing American Wood Council (drichardson@awc.org); Philip Line (pline@awc.org)

2018 International Building Code

Revise as follows:

TABLE 2308.7.3.1
 RAFTER TIE CONNECTIONS ^{a,1}

RAFTER-SLOPE	TIE SPACING (inches)	NO SNOW LOAD		GROUND SNOW LOAD (pound per square foot)									
				30 pounds per square foot					50 pounds per square foot				
		Roof span (feet)											
		12	20	28	36	12	20	28	36	12	20	28	36
Required number of 16d common (3 ¹ / ₂ " x 0.162") nails ^{a,b} per connection ^{c,d,e,f}													
3:12	12	4	6	8	10	4	6	8	11	5	8	12	15
	16	5	7	10	13	5	8	11	14	6	11	15	20
	24	7	11	15	19	7	11	16	21	9	16	23	30
	32	10	14	19	25	10	16	22	28	12	27	30	40
	48	14	21	29	37	14	32	36	42	18	32	46	60
4:12	12	3	4	5	6	3	5	6	8	4	6	9	11
	16	3	5	7	8	4	6	8	11	5	8	12	15
	24	4	7	10	12	5	9	12	16	7	12	17	22
	32	6	9	13	16	8	12	16	22	10	16	24	30
	48	8	14	19	24	10	18	24	32	14	24	34	44
5:12	12	3	3	4	5	3	4	5	7	3	5	7	9
	16	3	4	5	7	3	5	7	9	4	7	9	12
	24	4	6	8	10	4	7	10	13	6	10	14	18
	32	5	8	10	13	6	10	14	18	8	14	18	24
	48	7	11	15	20	8	14	20	26	12	20	28	36
7:12	12	3	3	3	4	3	3	4	5	3	4	5	7
	16	3	3	4	5	3	4	5	6	3	5	7	9
	24	3	4	6	7	3	5	7	9	4	7	10	13
	32	4	6	8	10	4	8	10	12	6	10	14	18
	48	5	8	11	14	6	10	14	18	9	14	20	26
9:12	12	3	3	3	3	3	3	3	4	3	3	4	5
	16	3	3	3	4	3	3	4	5	3	4	5	7
	24	3	3	5	6	3	4	6	7	3	6	8	10
	32	3	4	6	8	4	6	8	10	5	8	10	14
	48	4	6	9	11	5	8	12	14	7	12	16	20
12:12	12	3	3	3	3	3	3	3	3	3	3	3	4
	16	3	3	3	3	3	3	3	4	3	3	4	5
	24	3	3	3	4	3	3	4	6	3	4	6	8
	32	3	3	4	5	3	5	6	8	4	6	8	10
	48	3	4	6	7	4	7	8	12	6	8	12	16

RAFTER SLOPE	TIE SPACING (inches)	NO SNOW LOAD ^a		GROUND SNOW LOAD (pound per square foot)							
					30 pounds per square foot			50 pounds per square foot			
		Roof span (feet)									
		12	24	36	12	24	36	12	24	36	
Required number of 16d common (3-1/2" x 0.162") nails per connection ^{a,b,c,d,e,f,h}											
3:12	12	3	5	8	3	6	9	5	9	13	
	16	4	7	10	4	8	12	6	12	17	
	19.2	4	8	12	5	10	14	7	14	21	
	24	5	10	15	6	12	18	9	17	26	
	32	7	13	20	8	16	24	12	23	34	
	48	10	20	29	12	24	35	17	34	51	
4:12	12	3	4	6	3	5	7	4	7	10	
	16	3	5	8	3	6	9	5	9	13	
	19.2	3	6	9	4	7	11	6	11	16	
	24	4	8	11	5	9	13	7	13	19	
	32	5	10	15	6	12	18	9	17	26	
	48	8	15	22	9	18	26	13	26	38	
5:12	12	3	3	5	3	4	6	3	6	8	
	16	3	4	6	3	5	7	4	7	11	
	19.2	3	5	7	3	6	9	5	9	13	
	24	3	6	9	4	7	11	6	11	16	
	32	4	8	12	5	10	14	7	14	21	
	48	6	12	18	7	14	21	11	21	31	
7:12	12	3	3	4	3	3	4	3	4	6	
	16	3	3	5	3	4	5	3	5	8	
	19.2	3	4	5	3	4	6	3	6	9	
	24	3	5	7	3	5	8	4	8	11	
	32	3	6	9	4	7	10	5	10	15	
	48	5	9	13	5	10	15	8	15	22	
9:12	12	3	3	3	3	3	3	3	3	5	
	16	3	3	4	3	3	4	3	4	6	
	19.2	3	3	4	3	4	5	3	5	7	
	24	3	4	5	3	4	6	3	6	9	
	32	3	5	7	3	6	8	4	8	12	
	48	4	7	10	4	8	12	6	12	17	
12:12	12	3	3	3	3	3	3	3	3	4	
	16	3	3	3	3	3	3	3	3	5	
	19.2	3	3	3	3	3	4	3	4	6	
	24	3	3	4	3	3	5	3	5	7	
	32	3	4	5	3	4	6	3	6	9	
	48	3	5	8	3	6	9	5	9	13	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m².

a. 40d box (5" x 0.162") or 16d sinker (3 1/4" x 0.148") nails are 10d common (3" x 0.148") nails shall be permitted to be substituted for 16d common (3 1/2" x 0.162") nails where the required number of nails is taken as 1.2 times the required number of 16d common nails.

b. Nailing requirements are permitted to be reduced 25 percent if nails are clinche

e.b. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

d.c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.

e.d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

f.e. Connected members shall be of sufficient size to prevent splitting due to nailing.

f.f. For snow loads less than 30 pounds per square foot, the required number of nails is permitted to be reduced by multiplying by the ratio of actual snow load plus 10 divided by 40, but not less than the number required for no snow load.

g. Applies to roof live load of 20 psf or less.

h. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H _C /H _R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

i. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

Reason: Replace Table 2308.7.3.1 to be consistent with calculation basis of 2018 Wood Frame Construction Manual (WFCM) heel joint nailing requirements based on the 2018 National Design Specification for Wood Construction (NDS) provisions for nailed connections. The reduced number of 16d common nails required in rafter tie connections, by approximately 15%, are due to changes in penetration factor and load duration assumptions from those used to develop the existing table. The existing table used a 0.77 penetration factor (based on 1991 and 1997 NDS) for 16d common nails with less than 12d penetration in the main member and a load duration factor of 1.25 for all tabulated cells. The proposed revised nailing requirements are based on use of a 1.15 load duration factor for snow cases, 1.25 load duration factor for roof live load cases, and an effective penetration factor equal to 1.0 per 2001 NDS and later editions when nail lateral value calculations are based on the actual penetration in the wood member. The ratio of nail design values for snow cases originally used to develop nailing requirements to the current nail design values for snow cases is $(Z \times 0.77 \times 1.25) / (Z \times 1.0 \times 1.15) = 0.84$ and explains the reduced number of nails required by this proposal. Due to revised nail design provisions in the NDS, the benefit of a longer nail that is clinched is no longer recognized for this application and existing footnote b is removed. A 10d common nail option is added in new footnote "a." based on NDS lateral nail calculations. The table heading clarifies the 10psf dead load basis of the tabulated nailing requirements. Also, adjustment factors for rafter tie height, consistent with WFCM and IRC, are added in footnote "h." to increase connection requirements where the rafter tie not located in the bottom of the attic space (i.e. rafter ties located at the top of the support walls).

Bibliography: 1) 2018 Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings. American Wood Council, Leesburg, VA. 2018. <https://awc.org/pdf/codes-standards/publications/wfcm/AWC-WFCM2018-ViewOnly-1711.pdf>
2) 2018 National Design Specification (NDS) for Wood Construction. American Wood Council, Leesburg, VA. 2018. <https://awc.org/pdf/codes-standards/publications/nds/AWC-NDS2018-ViewOnly-171117.pdf>

Cost Impact: The code change proposal will decrease the cost of construction
This code change proposal utilizes fewer nails from the wood frame construction manual at less cost.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Replace Table 2308.7.3.1 to be consistent with calculation basis of 2018 Wood Frame Construction Manual (WFCM) heal joint nailing requirements based on the 2018 National Design Specification for Wood Construction (NDS) provisions for nailed connections.
(Vote: 14-0)

Assembly Action:

None

S187-19

Individual Consideration Agenda

Public Comment 1:

IBC@: TABLE 2308.7.3.1

Proponents:

Paul Coats, representing American Wood Council (pcoats@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

**TABLE 2308.7.3.1
RAFTER TIE CONNECTIONSⁱ**

RAFTER SLOPE	TIE SPACING (inches)	NO SNOW LOAD <u>LIVE LOAD ONLY^g</u>			GROUND SNOW LOAD (pound per square foot)					
					30 pounds per square foot			50 pounds per square foot		
		Roof span (feet)								
		12	24	36	12	24	36	12	24	36
Required number of 16d common (3-1/2" x 0.162") nails per connection ^{a, b, c, d, e, f, h}										
3:12	12	3	5	8	3	6	9	5	9	13
	16	4	7	10	4	8	12	6	12	17
	19.2	4	8	12	5	10	14	7	14	21
	24	5	10	15	6	12	18	9	17	26
	32	7	13	20	8	16	24	12	23	34
	48	10	20	29	12	24	35	17	34	51
4:12	12	3	4	6	3	5	7	4	7	10
	16	3	5	8	3	6	9	5	9	13
	19.2	3	6	9	4	7	11	6	11	16
	24	4	8	11	5	9	13	7	13	19
	32	5	10	15	6	12	18	9	17	26
	48	8	15	22	9	18	26	13	26	38
5:12	12	3	3	5	3	4	6	3	6	8
	16	3	4	6	3	5	7	4	7	11
	19.2	3	5	7	3	6	9	5	9	13
	24	3	6	9	4	7	11	6	11	16
	32	4	8	12	5	10	14	7	14	21
	48	6	12	18	7	14	21	11	21	31
7:12	12	3	3	4	3	3	4	3	4	6
	16	3	3	5	3	4	5	3	5	8
	19.2	3	4	5	3	4	6	3	6	9
	24	3	5	7	3	5	8	4	8	11
	32	3	6	9	4	7	10	5	10	15
	48	5	9	13	5	10	15	8	15	22
9:12	12	3	3	3	3	3	3	3	3	5
	16	3	3	4	3	3	4	3	4	6
	19.2	3	3	4	3	4	5	3	5	7
	24	3	4	5	3	4	6	3	6	9
	32	3	5	7	3	6	8	4	8	12
	48	4	7	10	4	8	12	6	12	17
12:12	12	3	3	3	3	3	3	3	3	4
	16	3	3	3	3	3	3	3	3	5
	19.2	3	3	3	3	3	4	3	4	6
	24	3	3	4	3	3	5	3	5	7
	32	3	4	5	3	4	6	3	6	9
	48	3	5	8	3	6	9	5	9	13

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m².

a. 10d common (3" x 0.148") nails shall be permitted to be substituted for 16d common (3 1/2" x 0.162") nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.

- b. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.
- c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.
- d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
- e. Connected members shall be of sufficient size to prevent splitting due to nailing.
- f. For snow loads less than 30 pounds per square foot, the required number of nails is permitted to be reduced by multiplying by the ratio of actual snow load plus 10 divided by 40, but not less than the number required for no snow load.
- g. Applies to roof live load of 20 psf or less.
- h. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically above from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties.

H_R = Height of roof ridge measured vertically above from the top of the rafter support walls to the bottom of the roof ridge.

When H_C / H_R exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

- i. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

Commenter's Reason: Several clarifications were suggested by the Structural Committee, and they are contained in this public comment: 1) a column heading is changed to clarify that it applies to live loads only, with a limit of 20 lbs. per footnote "g"; 2) text is added to footnote "a" to clarify that results should be rounded to the next full nail; 3) a clarifying sentence is added beneath the table in footnote "h" to clarify that rafter tie connections higher than $H_C / H_R = 1/3$ in the attic space must be engineered; and 4) the definitions of H_C and H_R are clarified to show how they should be measured.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment clarifies the intent of the original proposal, which could represent some cost savings due to efficiencies in the table content, depending on application.

S190-19

IBC: 2405.1, 2405.3, 2405.3.1 (New), 2405.3.2 (New), 2405.3.3 (New)

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

2018 International Building Code

Revise as follows:

2405.1 Scope. This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope of more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.3 Screening. ~~Where used in monolithic glazing systems, heat strengthened and fully tempered glass shall have screens installed below the glazing material. The screens and their fastenings~~ Broken glass retention screens, where required, shall be: capable of supporting twice the weight of the glazing; firmly and substantially fastened to the framing members; and installed within 4 inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. ~~Heat strengthened glass, fully tempered glass and wired glass, where used in multiple layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.~~

Exception: In monolithic and multiple layer sloped glazing systems, the following applies:

- ~~1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 feet (3048 mm) or less above the walking surface.~~
- ~~2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.~~
- ~~3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.~~
- ~~4. Screens shall not be required in individual dwelling units in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met:~~

- ~~4.1. Each pane of the glass is 16 square feet (1.5 m²) or less in area.~~
- ~~4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.~~
- ~~4.3. The glass thickness is $\frac{3}{16}$ inch (4.8 mm) or less.~~

~~5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used in individual dwelling units in Groups R-2, R-3 and R-4 within the following limits:~~

- ~~5.1. Each pane of glass is 16 square feet (1.5 m²) or less in area.~~
- ~~5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.~~

Add new text as follows:

2405.3.1 Screens under monolithic glazing Heat-strengthened glass, annealed glass, wired glass and fully tempered glass shall have screens installed below the full area of the glazing material.

2405.3.2 Screens under multiple-layer glazing. Heat-strengthened glass, fully tempered glass, annealed glass and wired glass, glazing used as the bottom glass layer shall have retention screens installed below the full area of the glazing material.

2405.3.3 Screens not required. For all other types of glazing complying with Section 2405.2, retention screens shall not be required.

Exception: In monolithic and multiple-layer sloped glazing systems, the following apply; which includes laminated glass with a 30-mil interlayer.

1. Fully tempered glass shall not be required to be installed with retention screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane, and having the highest point of the glass 10 feet (3048 mm) or less above the walking surface.
2. Retention screens shall not be required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Retention screens shall not be required below any glazing material, including annealed glass, the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.

4.Retention screens shall not be required in individual dwelling units in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and all of the following conditions are met:

4.1.Each pane of the glass is 16 square feet (1.5 m2) or less in area.

4.2.The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.

4.3.The glass thickness is 3/16 inch (4.8 mm) or less.

5.Retention screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used in individual dwelling units in Groups R-2, R-3 and R-4, and both of the following conditions are met:

5.1.Each pane of glass is 16 square feet (1.5 m²) or less in area.

5.2.The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

Reason: The current code language that states when screens are required below unit skylights and sloped glazing, has frequently been difficult to interpret by jurisdictions, causing consumers and others great concern when they are incorrectly told they need to install a glass retention screen below conforming (30-mil interlayer) laminated glass. Skylight and sloped glazing system manufacturers are asked to intervene far too frequently to ensure that unsightly, unnecessary screens are not installed in these instances. Furthermore, it is believed that many times an optional skylight installation is removed from submitted plans due to misinterpretation at the plan check stage, where the supplier may never know that the issue was raised because the permit applicant may surrender rather than appeal.

The current code language addresses qualifying laminated glass by simple omission from the "screens required" section. It is this omission that seems to create the confusion within the industry, especially considering Exception 5, which mentions that screens may be required when non-qualifying (15-mil interlayer) laminated glass is used.

This proposed code change simply rewrites this section to state clearly that laminated glass with 30-mil interlayer does not require screens. Specifically addressing the inapplicability of screens under laminated glass in the new section 2405.3.3 should reduce the frequency of misinterpretations that have been experienced. Adding the modifier, "broken glass retention" fully describes the screen's purpose. This is to ensure readers do not confuse them with insect screens or fall protection screens, which are physically different and will not serve as effective retention screens.

None of the proposed changes affect the current code requirements; rather, the intent and only expected outcomes of this proposal are simply for better clarity and more consistent enforcement.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposal should have a nominal effect on the cost of construction as the changes presented are not meant to alter the current requirements but simply meant to provide better clarity and more consistent enforcement.

S190-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that, as written, the proposed reorganization of the code appears to cause more confusion than clarity.

(Vote: 13-1)

Assembly Action:

None

S190-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 2405.1, 2405.2, 2405.3

Proponents:

Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Building Code

2405.1 Scope. This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope of more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.2 Allowable glazing materials and limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1.

Annealed glass is permitted to be used as specified in Exceptions 2 and 3 of Section 2405.3.

Laminated glass and plastic materials described above shall not require the screening or height restrictions provided in Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. Glass-block construction shall conform to the requirements of Section 2110.1.

2405.3 Screening. Where used in monolithic glazing systems, annealed, heat-strengthened, ~~and~~ fully tempered and wired glass shall have broken glass retention screens installed below the glazing material. The screens and their fastenings shall be: capable of supporting twice the weight of the glazing; firmly and substantially fastened to the framing members; and installed within 4 inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. Annealed, H heat-strengthened ~~glass~~, fully tempered ~~glass~~ and wired glass, where used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

Exception: In monolithic and multiple-layer sloped glazing systems, the following applies:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 feet (3048 mm) or less above the walking surface.
2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.
4. Screens shall not be required in individual *dwelling units* in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met:
 - 4.1. Each pane of the glass is 16 square feet (1.5 m²) or less in area.
 - 4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.
 - 4.3. The glass thickness is ³/₁₆ inch (4.8 mm) or less.
5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used in individual *dwelling units* in Groups R-2, R-3 and R-4 within the following limits:
 - 5.1. Each pane of glass is 16 square feet (1.5 m²) or less in area.
 - 5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

Commenter's Reason: The current code language that states when screens are required below unit skylights and sloped glazing, has frequently been difficult to interpret by jurisdictions, causing consumers and others great concern when they are incorrectly told they need to install a glass retention screen below conforming (30-mil interlayer) laminated glass. Skylight and sloped glazing system manufacturers are asked to intervene far too often to ensure that unsightly, unnecessary screens are not installed in these instances. Furthermore, it is believed that many times an optional skylight installation is removed from submitted plans due to misinterpretation at the plan check stage, where the supplier may never know that the issue was raised because the permit applicant may surrender rather than appeal.

The current code language addresses qualifying laminated glass by simple omission from the "screens required" section. It is the omission that seems to create the confusion within the industry, especially considering Exception 5, which mentions that screens may be required when non-qualifying (15-mil interlayer) laminated glass is used.

The initial code proposal submitted attempted to re-write the section to make it clear that laminated glass with 30-mil interlayer does not require screens. However, it was determined at the committee action hearings the initial attempt to reorganize and provide this clarity was actually more

confusing. Taking that input this public comment attempts to once again make it clear that laminated glass with 30-mil interlayer does not require screens, but in what we think is a much more clear and direct manner. We believe this addresses the committee's concerns.

In instances where screens are required, the public comment adds the modifier, "broken glass retention" to fully describe the screen's purpose. This is to ensure readers do not confuse these type of screens with insect screens or fall protection screens, which are physically different and will not serve as effective retention screens. The public comment also provides minor "clean up" to ensure all types of glass addressed in Section 2405.3, are listed in the opening paragraph.

None of what is being proposed changes the current code requirements; rather, the intent and only expected outcome of the public comment is to simply provide better clarity and more consistent enforcement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The changes presented are not meant to alter the current code requirements but simply meant to provide clarity and more consistent enforcement.

Public Comment# 1345

S191-19

IBC®: 2405.2

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

2018 International Building Code

Revise as follows:

2405.2 Allowable glazing materials and limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1.

Annealed glass is permitted to be used as specified in Exceptions 2 and 3 of Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. ~~Glass block construction shall conform to the requirements of Section 2110.1.~~

Reason: The removal of the reference in Section 2405.2 to the "Glass block" section is suggested as it removes a non-germane statement. That section contains no provisions that would apply on roofs or sloped walls, and Section 2405 offers no guidance on the use or protections needed for glass block. The reference is out of place here and should be removed. Perhaps there is a better section in Chapter 24 for it to appear, if it is needed at all.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This change will not have an effect on cost as it is not removing the requirements in Section 2110 but just removing the reference that is not germane within Section 2405.

S191-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee consensus was that the proposal was deleting a required pointer in the code.
(Vote: 11-3)

Note: the committee vote for 'as submitted' failed 7 for and 8 against.

Assembly Action:

None

S191-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

requests As Submitted

Commenter's Reason: The removal of the reference in section 2405.2 to the "Glass Block" section is suggested as it removes a non-germane statement. The glass-block construction section contains no provisions that would apply on roofs or sloped walls. Further, section 2405.2 offers no guidance on the use or protections needed for glass block. The reference is simply out of place here.

In addition, any concern that by removing this sentence one is eliminating a necessary pointer in Chapter 24 to the glass block provisions, is alleviated by the fact a reference is included in section 2406.1.3. The reference is more appropriate here in the safety glazing section where Glass Block is specifically called out in section 2406.1.3. Further, the reference here in section 2406.1.3 points you to the entire section on glass block, referring you to section 2110 whereas in Section 2405.2 it points you only to a subsection, 2110.1.

SECTION 2406 SAFETY GLAZING

2406.1 Human impact loads.

Individual glazed areas, including glass mirrors, in hazardous locations as defined in Section 2406.4 shall comply with Sections 2406.1.1 through 2406.1.4.

Exception: Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

2406.1.1 Impact test.

Except as provided in Sections 2406.1.2 through 2406.1.4, all glazing shall pass the impact test requirements of Section 2406.2.

2406.1.2 Plastic glazing.

Plastic glazing shall meet the weathering requirements of ANSI Z97.1.

2406.1.3 Glass block.

Glass-block walls shall comply with Section 2110.

2406.1.4 Louvered windows and jalousies.

Louvered windows and jalousies shall comply with Section 2403.5.

Bibliography: See section 2406.1.3 of the 2018 IBC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The change will not have any effect on costs as its not removing or changing any code requirements. Rather it is simply removing a pointer that is not germane within section 2405 and that is already included in section 2406 where it is more appropriate.

Public Comment# 1305

S193-19

IBC®: 2407.1.1 (New)

Proposed Change as Submitted

Proponents: Anthony Barnes, Trex Commercial Products, representing self (tbarnes@trexcommercial.com); Bryan Wedan, Enclos, representing self

2018 International Building Code

Revise as follows:

2407.1.1 Loads. The ~~glass panels and their support system~~ shall be designed to withstand the loads specified in Section 1607.8. Glass ~~guard elements panels~~ shall be designed using a factor of safety of four applied to the modulus of rupture.

Reason: Allowable glass stress is traditionally determined by probabilistic methods (ASTM E1300) given particular load durations. The allowable stress decreases with a longer duration load (thus the factor of safety increases). Therefore the allowable stress calculated per ASTM E1300 effectively contains a factor of safety. This appears to be the intent of section 2407.1.1 and the code commentary does suggest this (see attachments) as it mentions probability of glass breakage and that 4x the load is not to be applied to a railing system. The factor of safety of four should only be applied to glass. All other components supporting glass should be designed using the factors of safety provided in relevant material codes (AISC 360 for steel, etc.). All other glass systems such as skylights and walls are designed in the same manner and carry no less risk than guards.

There are also inconsistencies and ambiguities with the current code language. The factor of safety does not define which supports the factor of safety of 4 is to be applied to (loads must be transferred to ground, so where does glass support end?). The language is inconsistent in that other railing types are not designed with the same factor of safety of 4 even though failure modes could be similar. For example, a factor of safety of 4 may be applied to a steel post-supported glass infill railing system, but if a steel mesh panel infill is substituted for the glass, this panel and its supports would be designed with lower factors of safety per the relevant material codes and thus failure modes (including panels falling out of supports catastrophically) would occur at much lower loads.

In summary, changing this language removes ambiguity, makes guard design more consistent with other similar systems, and saves money by lowering factors of safety for supports (to those that are used by the relevant material codes).

Cost Impact: The code change proposal will decrease the cost of construction

Glass is already designed with factor of safety of 4 per 2407.1.1 so no change there. Factor of safety for steel, stainless steel, aluminum and concrete supports will be per relevant material codes and those factors are generally less than 4 (less costly) and are familiar to designers (less costly).

S193-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

2018 International Building Code

2407.1.1 Loads. The glass panels and their support system shall be designed to withstand the loads specified in Section 1607.8. Glass panels shall be designed using a factor of safety of four applied to the modulus of rupture.

Committee Reason: The proposal draws attention to the fact that glass panels are to be designed using a factor of safety of 4. The modification clarifies the intent of the proposal. (Vote: 11-2)

Assembly Action:

None

S193-19

Individual Consideration Agenda

Public Comment 1:

IBC®: 2407.1.1 (New)

Proponents:

Anthony Barnes, representing Self (tbarnes@trexcommercial.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

~~2407.1.1 Loads. The glass panels and their support system shall be designed to withstand the loads specified in Section 1607.8. Glass panels shall be designed using a factor of safety of four applied to the modulus of rupture.~~

The panels and their support system shall be designed to withstand the loads specified in Section 1607.8. When analyzed with these loads, the glass components of the handrails and guards shall be designed using the minimum allowable edge stresses as follows:

1. Fully tempered glass panels shall be designed using an allowable stress of 6.8 ksi.
2. Heat-strengthened glass panels used as guards shall be designed with an allowable stress of 3.1 ksi.

Exception: Alternate allowable stresses shall be permitted where justified by analysis using base stresses and methodology in ASTM E1300.

Commenter's Reason: The Structural Committee approved a stopgap measure (S193-19) that retained the load requirement for glass supports, but the above revised proposal enhances this approved modification is supported by technically correct, and accepted, methods for glass design. The differences between the above proposed language and the Committee-approved version (S193-19) are as follows:

- 1) This version uses accepted methods to set minimum allowable glass stresses (note that we arrive at basically the same values as were ambiguously *implied* in previous code versions using a now much more robust and technically appropriate analysis; previous code versions: $24 \text{ ksi MOR} / 4 = 6 \text{ ksi}$)
- 2) It is explicitly stated that alternate allowable stresses are permitted using the methodology outlined in ASTM E 1300

These minimum allowable edge stresses are based upon the following parameters:

- Base allowable stress values given in ASTM E1300 Table X7.1
- Glass probability or breakage equals 1 lite in 1000 (typical for life-safety applications and overhead glazing – see GANA Glazing Manual for example)
- The loads of Section 1607.8 are assumed to have a duration of 1 hour

There are three key drivers for the proposed updated language:

1. No glass design values are specified or referenced to which the “design factor” is applied;
2. Using the “design factor” terminology is technically problematic as simple design factors do not apply to brittle materials such as glass (see AAMA CW-12-84 and NCSEA Engineering Structural Glass Design Guide)
3. Allow design professionals to derive, using ASTM E 1300, and use, alternate allowable stresses

1.1 Point 1

Current **StopGap** language specifies the use of a “design factor” on the modulus of rupture (MoR), however 2407.1.1 currently does not specify a value or source to which to refer. To address this gap and fulfill the code intent, a “floor” value for glass design stress based on current accepted practice and standards is proposed. This floor value is a simplified design value based on conservative design assumptions that, when used without further analysis, would result in a safe glass guard design. Further effort to increase this floor value by rigorous engineering analysis is accommodated by reference to acceptable industry practice and standards.

1.2 Point 2

The use of Modulus of Rupture with an applied design factor is an inaccurate and outdated method by which to determine allowable design stresses (ref. GANA). Current techniques to determine allowable glass stress utilize probabilistic methods (explained in AAMA CW-12-84, GANA Glazing Manual, and ASTM E1300) based on, among other factors, a given load duration (allowable stress is greater for a short duration, and lower for a longer duration load), and acceptable risk of breakage ("probability of breakage" or P(breakage)). These methods augment material data, obtained by experiment and documented in ASTM standards, to suit the specific design situation.

The proposed allowable stresses are derived using ASTM E1300-16 per the below calculations. For glass in handrails and guards, a P(breakage) = 1:1000 and a 1 hr load duration is assumed. Furthermore allowable glass stresses also vary with location of the stress on the glass panel, either on the surface or the edge: The glass edge is conservatively considered, as the allowable stresses are lower at edges than for glass surfaces.

(It is noted that typical vertical glass applications assume a 3s load duration with a P(breakage) = 8:1000: the proposed 1 hr at 1:1000 is a significant increase in conservatism for the specific case of glass handrails and guards to reflect the "critical application".)

Following the proposed method, the design stresses proposed are similar in magnitude to the historical MoR/4 values but with a more robust derivation and clearer direction for the designer. This updated approach, based on documented ASTM methods of glass design, is particularly important as the codes are extended to the use of laminated glass and no top-cap in guards – design methods and techniques must keep pace with code requirements as higher performance is demanded from the material.

1.3 Point 3

Note that the approach used to derive the proposed allowable stresses is conservative when considering most guardrail applications: the proposed stress values address the balustrade condition of a single glass leaf, without top cap, cantilevering from an embedded shoe, subjected directly to crowd loading. Where not subject to these high demands, increased allowable stress limits could be used with more rigorous engineering analysis employed. For example, a shorter duration load may be appropriate (e.g. 3s duration for wind gust), or less demanding 4-side support conditions of infill panels ensure peak stresses occur on the glass surface. Extension of glass design stresses beyond the proposed floor values is limited to reference to associated design standards and outside of IBC scope.

Base stresses

Determine probability of breakage factor to convert from P(breakage) = 8:1000 stresses, as documented in ASTM E 1300, to equivalent P(breakage) = 1:1000 stresses

$$\begin{aligned} P_{b1} &:= 0.001 \\ P_{b2} &:= 0.008 \end{aligned} \quad \sigma_{\text{allowable}} = \left(\frac{P_b}{[k (d/3)^{2m} A]} \right)^{1/7} \quad (X6.1)$$

$$\psi_{Pb} := \frac{\left(\frac{P_{b1}}{P_{b2}} \right)^{\left(\frac{1}{7} \right)}}{\left(\frac{1}{7} \right)} = 0.743$$

TABLE X7.1 Allowable Edge Stress

	Clean Cut Edges, MPa (psi)	Seamed Edges, MPa (psi)	Polished Edges, MPa (psi)
Annealed	16.6 (2400)	18.3 (2650)	20.0 (2900)
Heat-strengthened	N/A ^a	36.5 (5300)	36.5 (5300)
Tempered	N/A	73.0 (10 600)	73.0 (10 600)

^a N/A—Not Applicable.

Use base stress of 10.6 ksi for probability of breakage of 8:1000 (from Table X7.1)

$$\sigma_{3_FT} := 10.6 \text{ ksi} \cdot \psi_{Pb} = 7.876 \text{ ksi}$$

allowable edge stress for FT glass, 1:1000 probability of breakage, 3s load duration, $\psi_{Pb} = 0.743$ per E1300 X6.1

$$d_{FT} := \begin{pmatrix} 3\text{-s} \\ 60\text{-s} \\ 1\text{-hr} \\ 12\text{-hr} \\ 10\text{-yr} \end{pmatrix}$$

$$\sigma_{\text{all_FT}} := \sigma_{3_FT} \left(3 \cdot \frac{s}{d_{FT}} \right)^{\left(\frac{1}{48} \right)}$$

per ASTM E1300-16 equation X5.1 using 'n' values found in Table 1 of ASTM E-2751

$$\sigma_{\text{all_FT}} = \begin{pmatrix} 7.876 \\ 7.399 \\ 6.794 \\ 6.451 \\ 5.36 \end{pmatrix} \text{ ksi}$$

$\sigma_{3_HS} := 5.3 \text{ ksi} \cdot \psi_{Pb} = 3.938 \text{ ksi}$ allowable edge stress for HS glass, 1:1000 probability of breakage, 3s load duration

$$d_{HS} := \begin{pmatrix} 3\text{-s} \\ 60\text{-s} \\ 1\text{-hr} \\ 12\text{-hr} \\ 10\text{-yr} \end{pmatrix}$$

$$\sigma_{\text{all_HS}} := \sigma_{3_HS} \left(3 \cdot \frac{s}{d_{HS}} \right)^{\left(\frac{1}{32} \right)}$$

per ASTM E1300-16 equation X5.1, where n = 32 per ASTM E2751 Table 1

$$\sigma_{\text{all_HS}} = \begin{pmatrix} 3.938 \\ 3.586 \\ 3.155 \\ 2.92 \\ 2.211 \end{pmatrix} \text{ ksi}$$

1 Additional response to committee comments:

Note that IBC Commentary includes the following clarification:

2407.1.1 Loads. The panels and their support system shall be designed to withstand the loads specified in Section 1607.7. A safety factor of four shall be used.

❖ This section requires that railing systems using glass balusters be designed based on a safety factor of four. Nominally identical panes of glass inherently have a wide variation in strength. The safety factor of four is used in the design to minimize the likelihood that breakage will occur below the design loads. **It is not intended that an in-place glass railing system be tested for or capable of withstanding four times the design load.**

This reads:

"This section requires that the support system for glass guard or handrail assemblies be designed based on a factor of safety of four. Nominally identical panes of glass inherently have a wide variation in strength. The safety factor of four is used in the design to minimize the likelihood that breakage will occur below the design loads. It is not intended that an in-place glass guard or handrail system be tested for or capable of withstanding four times the design load."

Bibliography:

- 1) GANA - Glazing Manual 50th Anniversary
- 2) AAMA CW-12-84
- 3) ASTM E 1300
- 4) ASTM E 2751

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The code change proposal will decrease the cost of construction. Factors of safety for steel, stainless steel, aluminum and concrete supports will be per relevant material codes and those factors are generally less than 4 (less costly) and are familiar to designers (less costly). Costly and protracted discussion on code ambiguity with permitting jurisdictions is mitigated by clear language based on current design methods and material knowledge.

Public Comment# 1394

Public Comment 2:

Proponents:

Tom Zaremba, representing Glazing Industry Code Committee (GICC), a section of the National Glass Association (NGA) (tzaremba@ralaw.com)

requests Disapprove

Commenter's Reason: The Glazing Industry Code Committee (GICC) urges you to disapprove S193-19. The proposal as modified, would make Section 2407.1.1 inconsistent with changes made in S192-19 that were unanimously approved by the Committee and, more importantly, it would make 2407.1.1 inconsistent with the language of design requirements specified in Section 1607.8 of the IBC.

As originally proposed, S193-19 was fatally flawed. It deleted the words "and their support systems" from the first sentence of Section 2407.1.1. That deletion would have eliminated the requirement that support systems for glass guards be designed to the loads specified in Section 1607.8. That error was corrected by the Committee's adoption of a modification adding that language back into 2407.1.1. However, in addition to making that correction to S193-19, the Committee allowed two other changes from the original proposal to stand, namely, changing "guard elements" to "panels," and adding "modulus of rupture" to the safety factor required by 2407.1.1.

Adopting these two changes from the original proposal are not justified for several reasons. First, the Committee unanimously recommended the adoption of S192-19, which changed Section 2407.1.1 to read as follows: "*Glass **handrails and guards** and their support system shall be designed*

to withstand the loads specified in Section 1607.8. All glass **handrails and guards** shall be designed using a factor of safety of four." (Emphasis added). The reason for this change was to ensure consistency between Section 2407.1.1 and Section 1607.8. In that regard, 1607.8.1 provides that: "**Handrails and guards** shall be designed to resist a linear load of 50 pounds per linear foot ... in accordance with ASCE 7. Glass **handrails and guards** shall comply with Section 2407." (Emphasis added).

Please note that in order to make 2407.1.1 consistent with 1608.1.1, S192-19 changed the word "panels" to "handrails and guards" in 2407.1.1. Then, after recommending the adoption of S192-19, the Committee recommended that "handrails and guards" be changed back to "panels" in S193-19. Adopting this change from S193-19 would restore the inconsistency between Sections 2407.1.1 and 1608.1 that S192-18 resolved.

Additionally, the Committee's recommendation as to S193-19 would add the term "modulus of rupture" to the safety factor required by 2407.1.1. However, the Committee's recommendation includes no information as to how to test for the "modulus of rupture," how to determine the modulus of rupture, or, for that matter what it means in this context. In that regard, the term "modulus of rupture" is not defined in the IBC. (Unlike here, where the term "modulus of rupture" is used in the IBC, the code specifies how it is to be determined. See, therefore, Section 2109.2.1.2.4.)

Section 1608.1 requires handrails and guards to "be designed to resist a linear load of 50 pounds per linear foot ... in accordance with ASCE 7." Section 1608.1 makes no mention of testing "modulus of rupture." Instead, it refers to testing in accordance with ASCE 7. If modulus of rupture is to be added to the design considerations applicable to handrails and guards, it should either be added to Section 1607.8.1 or to ASCE 7, but not to 2407.1.1. (And, if ASCE 7 requires modulus of rupture testing, then adding it to 2407.1.1 is unnecessary.)

The use of inconsistent and undefined terms inevitably leads to misinterpretations. Adopting S193-19 will result in inconsistent terms between Sections 1608 and 2407 of the IBC and should be disapproved. The Committee's modification restoring the "and their support systems" language is unnecessary since that language already appears in 2407.1.1. More importantly, however, the Committee got it wrong when it recommended changing the language of 2407.1.1 back to "panels" from "handrails and guards" as proposed in S192-19 since "handrails and guards" is the language used in 1608.1. The Committee again got it wrong when it recommended that "modulus of rupture" be added to the safety factor referenced in 2407.1.1. "Modulus of rupture" is not defined in the IBC and, if it belongs in the design considerations for handrails and guards, it should be included, if at all, either in Section 1608.1 or ASCE 7, but it should not be included in Section 2407.1.1.

The Glazing Industry Code Committee urges you to vote to disapprove S193-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1642

S194-19

IBC®: 2510.6

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Building Code

Revise as follows:

2510.6 Water-resistive barriers. *Water-resistive barriers* shall be installed as required in Section 1403.2 and, where applied over wood-based sheathing, shall include a water-resistive ~~vapor-permeable~~ barrier with a ~~performance-water resistance~~ at least equivalent to two layers of *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section 1404.4) intended to drain to the *water-resistive barrier* is directed between the layers.

Exceptions:

1. Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of a water-resistive barrier complying with ASTM E2556 ~~-, Type #1~~ and is separated from the stucco by an intervening ~~-, substantially nonwater-absorbing layer or drainage foam plastic insulating sheathing layer~~ or by a minimum 3/16 inch space.
2. Where the *water-resistive barrier* is applied over wood-based sheathing ~~in Climate Zone 1A, 2A or 3A, a ventilated air~~ where the annual mean rainfall as determined by the National Oceanic and Atmospheric Administration (NOAA) exceeds 20 inches, a minimum 3/16 inch space shall be provided between the stucco and *water-resistive barrier*.

Reason: Objective:

1. Define water resistance as the primary functional requirement of the WRB and remove reference to vapor permeable.
2. Enable a single layer of WRB complying with ASTM E2556 Type 1 with a drainage space.
3. Define depth drainage space.

The existing code language gives insufficient guidance for other approved materials. The added language addresses this issue and provides a specific performance requirement for water resistance and provides consistency with other sections of the code that relate specifically to water resistive barriers.

The size of the drainage space needs to be specified. Type 1 is the appropriate water-resistive metric for the specified space. This logic is consistent with the body and intent of the text of Section 2510.6. The specified space and one layer of Type 1 provides equivalent performance to the two layers of Type 1 specified in the body of 2510.6.

Annual mean rainfall is the appropriate metric for risk not humidity.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change gives better guidance for water-resistance.

S194-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that this change only confused the code content. The committee did not find sufficient justification for undefined terms such as 'approved weather data'.

(Vote: 14-0)

Assembly Action:

None

S194-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 2510.6

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

2510.6 Water-resistive barriers. *Water-resistive barriers* shall be installed as required in Section 1403.2 and, where applied over wood-based sheathing, shall include a water-resistive barrier with a water resistance at least equivalent to two layers of *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section 1404.4) intended to drain to the *water-resistive barrier* is directed between the layers.

Exceptions:

1. Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of a water-resistive barrier complying with ASTM E2556 Type I and is separated from the stucco by an intervening foam plastic insulating sheathing layer or by a minimum 3/16 inch space.
2. Where the *water-resistive barrier* is applied over wood-based sheathing in the moist or marine climate zones of Figure N1101.7 where the annual mean rainfall as determined by the National Oceanic and Atmospheric Administration (NOAA) exceeds 20 inches, a minimum 3/16 inch space shall be provided between the stucco and *water-resistive barrier* or a drainage layer having a drainage efficiency of not less than 90%, as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925, shall be added to the exterior side of the *water-resistive barrier*.

Commenter's Reason: The committee issue was and is addressed in the proposed modification.

Cleans up language relating to the function of a WRB so that S194 is now consistent with RB232 that passed in the IRC.

The modification makes the climate requirement for drainage consistent with the language in RB242 that passed in the IRC

The modification makes the requirement defining drainage consistent with the language in RB243 and RB242 that passed in the IRC

More significantly it recognizes that the most important factor relating to addressing the issues with stucco are drainage not the resistance to hydrostatic pressure. In other words drainage is more important than requiring a Type II water resistive barrier. A Type I water resistive barrier with drainage significantly outperforms a Type II water resistive barrier without drainage. ASTM E2556 does not address drainage.

ASTM E2556 requires materials to resist a water column of over 20 inches of water...a hydrostatic pressure greater than 5,000 pascals (an equivalent wind speed of 200 hundred miles per hour). The requirement is disingenuous when it is understood that sheet membranes are tested under ASTM E2556 without fasteners. Nails are required to install such products...as well as other products. Cladding fasteners then penetrate all products. The key is to control the hydrostatic pressure so the holes don't matter.

Requiring a Type II water resistive barrier creates an artificial barrier to entry for products and approaches that have been demonstrated to work. It excludes products such as OSB sheathings with integral water control layers manufactured by Georgia Pacific, Louisiana Pacific and Huber. It excludes many fluid applied water resistive barriers and it adds unnecessary expense to drainage mat and dimple matt drainage approaches where Type I water resistive barriers function well. Requiring Type II water resistive barriers favors mechanically attached sheet good based water resistive barriers despite evidence that they do not function adequately in stucco assemblies without a gap.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

Requiring materials to meet Type II requirements significantly increases costs relative to meeting Type I requirements. This requirement doubles the material per square foot cost of water resistive barriers resulting in cost increases on the order of thousands of dollars on multifamily and commercial projects. Therefore, this code change significantly reduces the cost of construction by thousands of dollars on multifamily and commercial projects.

Staff Analysis: ASTM E2925 is a new standard that was submitted to staff in accordance with CP28 in support of S196-19, in which the standard is referenced.

Note: Both S194-19 and S196-19 deal with the same section in different ways. If both are approved, please ensure the final intentions are clear.

Public Comment 2:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests Disapprove

Commenter's Reason: The committee recommended disapproval of S194 and this should be upheld for the reasons given by the IBC-S committee. This proposal included a number of problems including undefined terms such as "approved weather data". There is also concern that water-resistance was being reduced by changing from a Type II to Type I WRB in accordance with ASTM E2556. There was not adequate justification given for this change. Finally, it should be noted that all of these issues were resolved in S196 which was recommended for approval (14-0) by the committee noting that it "provides update of existing provisions to the latest technology and the drainage for correct climate zones." In addition, S196 is coordinated with RB242 which also was approved for the IRC. For these reasons, we request that S194-19 remain disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

S196-19

IBC: 2510.6, 2510.6.1 (New), 2510.6.2 (New), ASTM Chapter 35 (New)

Proposed Change as Submitted

Proponents: Mike Fischer, representing Self (mfischer@kellencompany.com); Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Building Code

Revise as follows:

2510.6 Water-resistive barriers. *Water-resistive barriers* shall be installed as required in Section 1403.2 and, where applied over wood-based sheathing, shall ~~comply with Section 2510.6.1 or Section 2510.6.2, include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section 1404.4) intended to drain to the water-resistive barrier is directed between the layers.~~

~~Exceptions:~~

- ~~1. Where the *water-resistive barrier* that is applied over wood-based sheathing has a water resistance equal to or greater than that of a *water-resistive barrier* complying with ASTM E2556, Type II and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or drainage space.~~
- ~~2. Where the *water-resistive barrier* is applied over wood-based sheathing in Climate Zone 1A, 2A or 3A, a ventilated air space shall be provided between the stucco and *water-resistive barrier*.~~

Add new text as follows:

2510.6.1 Dry climates. One of the following shall apply for dry (B) *climate zones*:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section 1404.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.
2. The *water-resistive barrier* shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of *water-resistive barrier* complying with ASTM E2556, Type II. The *water-resistive barrier* shall be separated from the stucco by a layer of foam plastic insulating sheathing or other nonwater absorbing layer.

2510.6.2 Moist or marine climates. In moist (A) or marine (C) *climate zones*, *water-resistive barrier* shall comply with one of the following:

1. In addition to complying with Item 1 or 2 of Section 2510.6.1, a minimum 3/16 inch (4.8 mm) space shall be added to the exterior side of the *water-resistive barrier*.
2. In addition to complying with Item 2 of Section 2510.6.1, a space with a minimum drainage efficiency of 90% as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925 is added to the exterior side of the *water-resistive barrier*.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

E2925-17: Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function

Reason: The proposal does two things. First, it reorganizes the provisions by deleting two exceptions (which are really a construction options or requirements) and replacing them with subsections that indicate different methods of complying with stucco water-resistive barrier requirements. Second, the proposal properly applies requirements in relation to climate zones (a defined term in Chapter 2) -- something that has been missing in the code and is needed to avoid higher risk of moisture problems in climates that are moist/rainy. The proposal will help resolve problems with stucco performance (e.g., moisture problems over wood-based sheathings) and avoid impacting cost or performance where stucco has a long-standing record of good performance (e.g., dry climates such as the southwestern region of the U.S.).

Cost Impact: The code change proposal will increase the cost of construction

The proposal will not increase cost for substrates other than wood-based sheathing. Also, it will not impact cost or change requirements in dry climates where stucco has a long record of successful performance. This also will not impact cost in moist or marine climates where similar actions are already being taken (e.g., a drainage space) to reduce risk of moisture damage.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E2925-17, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
2018 International Building Code

2510.6.1 Dry climates. One of the following shall apply for dry (B) *climate zones*:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section 1404.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.
2. The *water-resistive barrier* shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of *water-resistive barrier* complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other nonwater absorbing layer , or a drainage space.

2510.6.2 Moist or marine climates. In moist (A) or marine (C) *climate zones*, water-resistive barrier shall comply with of one of the following:

1. In addition to complying with Item 1 or 2 of Section 2510.6.1, a space or drainage material not less than minimum 3/16 inch (4.8 mm) in depth space shall be applied added to the exterior side of the *water-resistive barrier*.
2. In addition to complying with Item 2 of Section 2510.6.1, drainage on the exterior side of the water-resistive barrier shall have a space with a minimum drainage efficiency of 90% as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925 ~~is added to the exterior side of the water-resistive barrier.~~

Committee Reason: The proposal provides update of existing provisions to the latest technology and the drainage for correct climate zones. The modification adds additional options to satisfying the requirements. (Vote: 14-0)

Assembly Action:

None

S196-19

Individual Consideration Agenda

Public Comment 1:

IBC@: 2510.6.1 (New)

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Building Code

2510.6.1 Dry climates. One of the following shall apply for dry (B) *climate zones*:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section 1404.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.
2. The *water-resistive barrier* shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of *water-resistive barrier* complying with ASTM E2556, Type I or II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other nonwater absorbing layer, or a drainage space.

Commenter's Reason: Requiring materials to meet Type II requirements significantly increases costs relative to meeting Type I requirements.

This requirement doubles the material cost per square foot of water resistive barriers resulting in cost increases on the order of thousands of dollars on multifamily and commercial projects. Therefore, this code change significantly reduces the cost of construction by thousands of dollars on multifamily and commercial projects.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This code change decreases costs.

Requiring materials to meet Type II requirements significantly increases costs relative to meeting Type I requirements. This requirement doubles the material cost per square foot of water resistive barriers resulting in cost increases on the order of thousands of dollars on multifamily and commercial projects. Therefore, this code change significantly reduces the cost of construction by thousands of dollars on multifamily and commercial projects.

Staff Analysis: Note: Both S194 and S196 deal with the same section in different ways. If both are approved, please ensure the final intentions are clear.

Public Comment# 1934

Public Comment 2:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Committee

Commenter's Reason: We request this proposal be approved in accordance with the Committee Action at the CAH. The proponents testified that:

- The structure of this proposal is useful in that the more restrictive provisions are located in the main body of the text instead of placing these provisions in the exception statement.
- The problem to be solved is moisture performance issues with stucco in moist and marine climate zones. The reason for the problem is that dry climate zone installation techniques, currently required by code, are inadequate to reduce risk of moisture damage and do not provide for adequate drainage behind the stucco.
- The proposal breaks the requirements into a dry and moist/marine climate zone solution. There is a prescriptive solution – a 3/16" gap or drainage material and a performance solution which is a drainage efficiency requirement in accordance with ASTM standards.
- The water-resistive barrier requirements are retained as currently prescribed by code, and are specified in accordance with ASTM E2556, Type II, which has been in the code since 2006 and a part of ICC-ES AC-11 requirements beforehand.
- Opposition to the proposal supported the air gap and drainage plane, but also wanted to lower the WRB moisture performance by changing from a Type II down to a Type I. This was the intent of the other stucco proposals RB243/S194. This was not our original intent, as we have no supporting data or long-term performance studies to support this approach, either on a material or an assembly basis. Furthermore, the IBC-S committee ruled against S194 on lowering the WRB requirement, but both committees supported our proposals (RB242/S196) to add the air gap/drainage plane.

For the above reasons and to maintain consistency between the IRC and IBC, we therefore request your support of the committee action for approval of S196 as modified by committee.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Refer to the cost impact statement with the original S196 proposal. There is no change.

Public Comment# 1974

S200-19

IBC: 202 (New), 1609.1.1, 1613.1, 3103.1.1, 3103.5 (New), 3103.6 (New), ASCE Chapter 35 (New), ESTA Chapter 35 (New)

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

2018 International Building Code

Add new definition as follows:

TEMPORARY SPECIAL EVENT STRUCTURE. Any temporary ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower supporting audio or visual effects equipment or similar structures.

Revise as follows:

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. Temporary special event structures complying with Section 3103.5.5.

The wind speeds in Figures 1609.3(1) through 1609.3(8) are basic design wind speeds, V , and shall be converted in accordance with Section 1609.3.1 to *allowable stress design* wind speeds, V_{asd} , when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S , is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. Temporary special event structures complying with Section 3103.5.

3103.1.1 Conformance. Temporary structures and uses shall conform to the structural strength, durability, fire safety, *means of egress*, accessibility, light, *ventilation* and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

Add new text as follows:

3103.5 Structural. The structural design for temporary structures shall comply with the requirements in Chapter 16. Temporary special event structures erected outdoors for a period of not more than six consecutive weeks shall be designed and erected to comply with requirements ESTA ANSI E1.21 as well as the lateral forces in ASCE 37.

3103.6 Durability and maintenance. A qualified person shall inspect temporary special event structures, including components, when purchased

or acquired and at least once per year, based on the requirements in ESTA ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the building official. Additionally, temporary special event structures shall be inspected at regular intervals when in service to ensure that the structure continues to perform as designed and initially erected.

ASCE/SEI

American Society of Civil
Engineers Structural Engineering Institute
1801 Alexander Bell Drive
Reston VA 20191-4400

37-14: Design Loads on Structures during Construction

Add new standard(s) as follows:

ESTA

Entertainment Services and Technology
Association
630 Ninth Avenue, Suite 609
New York NY 10036
US

ANSI E1.21—2013: Entertainment Technology: Temporary Ground Supported Overhead Structures Used to Cover the Stage Areas and Support Equipment in the Production of Outdoor Entertainment Event

Reason: Temporary Special Event Structures are regulated in Section 3105 of the International Fire Code and pose challenges to Building Officials and Fire Code Officials due to their temporary nature and methods of construction. The regular provisions of the IBC and IFC regulate permanent buildings and structures constructed to remain in service for long periods of time and as a consequence it is conceivable that over a 50 to 100 year services live that such buildings and structures can be expected to experience high wind and seismic. As a result when the duration of service is short for 6 weeks for example such as a sporting event, or one day such as in a concert, it is reasonable to assume that the probability of an event will not be high. Furthermore, wind events can be predicted fairly accurately to allow for adjustments or dismantling of temporary structures when an installation may be subjected to winds higher than assumed in the design. As a consequence the entertainment industry developed "ANSI E1.21—2013: Entertainment Technology: Temporary Ground Supported Overhead Structures Used to Cover the Stage Areas and Support Equipment in the Production of Outdoor Entertainment Events" to specifically address the unique issues posed by temporary structures used as a part of special events in light of the duration of use and the reuse of components used to erect the structures. Additionally, these temporary structures may be erected with scaffolding systems that were intended for the construction of permanent buildings.

The definition for Temporary Special Event Structure is proposed to be modified to delete references limiting its applicaiton to the IFC.

IFC Section 3105 adopts by reference ANSI E1.21 so this code change merely harmonizes the two codes. It is noteworthy that ANSI E1.21 was last updated in 2013 and includes out of date references to 2010 edition of ASCE 7 as well as the 2002 edition of ASCE 37.

This code change also references ASCE 37-14 Design Loads on Structures during Construction since this standard is referenced in ANSI E1.21 and since by publishing it ASCE recognizes the need for reduced seismic loads adjusted by duration. It is worth noting that ASCE 37 intends to provide the same level of safety as the IBC does through ASCE 7.

Bibliography: ANSI E1.21—2013: Entertainment Technology: Temporary Ground Supported Overhead Structures Used to Cover the Stage Areas and Support Equipment in the Production of Outdoor Entertainment Events
ASCE 37-14 DDesign Loads on Structures During Construction

Cost Impact: The code change proposal will decrease the cost of construction

Building Official are requested on a regularat basis to accespt structural designs for concert stages and structures used in sporting events based on load reductions permitted in the two new referenced standards. As a consequence of this code change it is expected that ballast materials used to provide overturing and sliding resistance to be reduced. These standards are already in use in the motion picture and entertainment industry for work not specifically regulated by the Building Official.

Staff Analysis: A review of the standard proposed for inclusion in the code, ESTA ANSI E1.21-2013 and ASCE 37-14, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

S200-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee agreed with the need for provisions relative to 'temporary special event structures'; however, the committee

could not agree with a proposal that relied on ASCE 37 for temporary loads when the type of structure being considered is outside the scope of ASCE 37. ASCE representatives specifically testified that ASCE 37 is inappropriately being referenced in this proposal. The committee expressed concerns over 'who is responsible' and 'who would do the inspections'. (Vote: 13-1)

Assembly Action:

None

S200-19

Individual Consideration Agenda

Public Comment 1:

IBC®: (New), 1609.1.1, 1613.1, 3103.1, 3103.5 (New), ANSI Chapter 35 (New), ASCE/SEI Chapter 35 (New), ESTA (New)

Proponents:

Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

~~**TEMPORARY SPECIAL EVENT STRUCTURE:** Any temporary ground-supported structure, platform, stage, stage scaffolding or rigging; canopy, tower supporting audio or visual effects equipment or similar structures.~~

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. ~~Temporary special~~ Special event structures complying with Section 3103.5.5.

The wind speeds in Figures 1609.3(1) through 1609.3(8) are basic design wind speeds, V , and shall be converted in accordance with Section 1609.3.1 to *allowable stress design* wind speeds, V_{asd} , when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S , is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.

4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. ~~Temporary special~~ Special event structures complying with Section 3103.5.

3103.1 General. The provisions of Sections 3103.1 through ~~3103.4~~ 3103.5 shall apply to structures erected for a period of less than 180 days. Tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall comply with the International Fire Code . Those erected for a longer period of time shall comply with applicable sections of this code.

3103.5 Structural. The structural design for temporary structures shall comply with the requirements in Chapter 16. ~~Temporary special~~ Special event structures erected outdoors for a period of not more than six consecutive weeks shall be designed and erected to comply with requirements ~~ESTA-ANSI E1.21 as well as the lateral forces in ASCE 37.~~

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York NY 10036

ANSI E1.21—2013:

Entertainment Technology: Temporary Ground Supported Overhead Structures Used to Cover the Stage Areas and Support Equipment in the Production of Outdoor Entertainment Events

ASCE/SEI

American Society of Civil
Engineers Structural Engineering Institute
1801 Alexander Bell Drive
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~~37-14: Design Loads on Structures during Construction~~

ESTA

Entertainment Services and Technology
Association
630 Ninth Avenue, Suite 609
New York NY 10036
US

~~ANSI E1.21—2013: Entertainment Technology: Temporary Ground Supported Overhead Structures Used to Cover the Stage Areas and Support Equipment in the Production of Outdoor Entertainment Event~~

Commenter's Reason: The original proposal has been simplified from what was originally submitted and remains true to the original goal to correlate the IBC and the IFC. The IFC references the IBC numerous times in IFC Ch 31 and intends to not duplicate requirements in the IBC. Additionally the Section 108.1 of the IBC authorized the Building Official to issue a permit for temporary structures and temporary uses but does not require it. However IFC Section 3105.5 requires that certain documents (structural plans and calculations) be submitted to the fire code official and the building official for review before a permit is approved.

The definition for temporary special event structure was deleted since the definition of special event structure was added to the 2018 IBC in code change G147-18.

The reference to ASCE 37 was also removed from the proposal in response to comments from ASCE during testimony at the CAH. It is interesting that ASCE's objections are due to safety personnel being present on construction sites and the lack of public access yet ASCE 37 can be used to shore bridges constructed over freeways, used to support construction scaffolding and equipment above public sidewalks and to shore up portions of occupied buildings undergoing structural renovations.

The ANSI E1.21—2013 is adopted in the 2018 IBC and includes loading requirements for wind and earthquake. And as frequently occurs with standards mismatches ASCE 7-10 is referenced in the ANSI standard as well as ASCE 37-02. While the original proposal was trying to correct the mismatch ASCE opposed the reference to ASCE 37 directly through the IBC.

During the CAH hearing we spent a considerable amount of time discussing the code change with questions raised by almost all the committee members. While the committee voted to disapprove the code change the committee was receptive to the need to treat temporary structures differently. We had many speakers in support from numerous jurisdictions. The only speakers in opposition were from ASCE regarding the reference to ASCE 37. One comment that resonated is that Building Officials permit temporary structures to be supported on ground without a permanent concrete, masonry or wood foundation and ballast is permitted to provide for sliding resistance through friction and for wind uplift.

Supporting the original proposal were structural engineers representing firms that work on almost 75% of the temporary structures in the United

States and they are designing to what is being proposed including updates to the ANSI standard and ASCE 7.

The public comment has simplified the code change to better correlate with the fire code and the results of the group B code change. Please vote to support approval through public comment # 4 we need 2/3 of the governmental voting members to vote in the affirmative for the public comment to pass.

TENTS, TEMPORARY SPECIAL EVENT STRUCTURES AND OTHER MEMBRANE STRUCTURES

and the system shall be installed in accordance with NFPA 70. The emergency system provided shall have a minimum duration of 90 minutes when operated at full design demand.

3103.12.7 Means of egress illumination. Means of egress shall be illuminated with light having an intensity of not less than 1 foot-candle (11 lux) at floor level while the structure is occupied. Fixtures required for means of egress illumination shall be supplied from a separate circuit or source of power.

3103.12.8 Maintenance of means of egress. The required width of exits, aisles and passageways shall be maintained at all times to a public way. Guy wires, guy ropes and other support members shall not cross a means of egress at a height of less than 8 feet (2438 mm). The surface of means of egress shall be maintained in an approved manner.

SECTION 3104
TEMPORARY AND PERMANENT TENTS
AND MEMBRANE STRUCTURES

3104.1 General. Tents and membrane structures, both temporary and permanent, shall be in accordance with this section and Sections 3105 and 3107. Permanent tents and membrane structures shall also comply with the International Building Code.

3104.2 Flame propagation performance treatment. Before a permit is granted, the owner or agent shall file with the fire code official a certificate executed by an approved testing laboratory. The certificate shall indicate that the floor coverings, tents, membrane structures and their appurtenances, which include sidewalls, drops and tarpaulins, are composed of materials meeting the flame propagation performance of Test Method 2 of NFPA 701. Additionally, it shall indicate that the bunting and combustible decorative materials and effects are composed of material meeting the flame propagation performance criteria of Test Method 1 or Test Method 2 of NFPA 701, as applicable. Alternatively, the materials shall be treated with a flame retardant in an approved manner and meet the flame propagation performance criteria of the applicable test method of NFPA 701. The flame propagation performance criteria shall be effective for the period specified by the permit.

3104.3 Label. Membrane structures or tents shall have a permanently affixed label bearing the identification of size and fabric or material type.

3104.4 Certification. An affidavit or affirmation shall be submitted to the fire code official and a copy retained on the premises on which the tent or air-supported structure is located. The affidavit shall attest to all of the following information relative to the flame propagation performance criteria of the fabric:

- 1. Names and address of the owners of the tent or air-supported structure.
- 2. Date the fabric was last treated with flame-retardant solution.

- 3. Trade name or kind of chemical used in treatment.
- 4. Name of person or firm treating the material.
- 5. Name of testing agency and test standard by which the fabric was tested.

SECTION 3105
TEMPORARY SPECIAL EVENT STRUCTURES

3105.1 General. Temporary special event structures shall comply with Section 3104, Sections 3105.2 through 3105.9 and ANSI E1.21.

3105.2 Approval. Temporary special event structures in excess of 400 square feet (37 m²) shall not be erected, operated or maintained for any purpose without first obtaining approval and a permit from the fire code official and the building official.

3105.3 Permits. Permits shall be required as set forth in Sections 105.6 and 105.7.

3105.4 Use period. Temporary special event structures erected in accordance with ANSI E1.21 shall not be erected for a period of more than six consecutive weeks.

3105.5 Required documents. The following documents shall be submitted to the fire code official and the building official for review before a permit is approved:

- 1. Construction documents: Construction documents shall be prepared by a registered design professional in accordance with the International Building Code and ANSI E1.21 where applicable. Construction documents shall include:
 - 1.1. A summary sheet showing the building code used, design criteria, loads and support reactions.
 - 1.2. Detailed construction and installation drawings.
 - 1.3. Design calculations.
 - 1.4. Operating limits of the structure explicitly outlined by the registered design professional including environmental conditions and physical forces.
 - 1.5. Effects of additive elements such as video walls, supported scenery, audio equipment, vertical and horizontal coverings.
 - 1.6. Means for adequate stability including specific requirements for guying and cross-bracing, ground anchors or ballast for different ground conditions.
- 2. Designation of responsible party: The owner of the temporary special event structure shall designate in writing a person to have responsibility for the temporary special event structure on the site. The designated person shall have sufficient knowledge of the construction documents, manufacturer's recommendations and operations plan to make judgments regarding the structure's safety and to coordinate with the fire code official.

G147-18

IBC: SECTION 202, 202 (New), 3103.1

Proponent: Richard Nix, representing Entertainment Services & Technology Association/Event Safety Alliance (rnix@zoomtown.com)

2018 International Building Code

SECTION 202 DEFINITIONS

Add new definition as follows:

SPECIAL EVENT STRUCTURE. Any ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower or similar structure supporting entertainment-related equipment or signage.

Revise as follows:

3103.1 General. The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. ~~Tents, special event structures, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the International Fire Code. These erected for a longer period of time shall comply with applicable sections of this code.~~

Reason:

These structures are covered under the scope of IBC Chapter 31, Special Construction. IBC Section 3103 addresses installations <180 days, which are considered "temporary". Temporary tents, any type of membrane covered structure and special events structures are therefore within the scope of IBC Chapter 31, section 3102 and/or section 3103. All of these structures except special event structures are referred to IFC Chapter 31. The IFC has added new requirements in Chapter 31 for special events structures, therefore special event structures must also be referred from IBC Chapter 31 to IFC Chapter 31.

Building Code Officials and others using the IBC as a primary code reference require the proper guidance and direction to IFC Chapter 31. In the last code change cycle, F308-16 replaced the IFC term temporary stage canopy with the term temporary special events structure. Therefore, Temporary special events structures are now covered under the purview of IFC Chapter 31. Coordination with IBC Chapter 31 was both implied and intended to occur as a result of F308-16, due to the special construction and temporary characteristics of these structures. However, that coordination did not occur. This CCP ensures proper coordination between IFC and IBC as intended in the last code change cycle.

This proposed definition for Special Events Structures in IBC is slightly different than that used in IFC, because the word "temporary" is implied by the corresponding IBC section 3103, where these structures are currently mentioned.

Cost Impact

The code change proposal will not increase or decrease the cost of construction .

The proposed change adds a definition for clarity along with a pointer for code coordination.

Internal ID: 311

G325

Committee Action: **Disapproved**

Committee Reason: This requirement is very limiting and doesn't allow for the alternatives that are regularly applied in the field. The language in the 2018 code extends these requirements to occupant elevators. In buildings with fire service elevators, the owners often would like them to serve multiple uses and we cannot preclude the idea that there will be other occupants in them, which drags accessibility into the mix. (Vote: 14-0)

Assembly Motion: **NONE**

G145-18

Committee Action: **Disapproved**

Committee Reason: This provision for elevator hoistway pressurization are now voluntary in lieu of providing elevator lobbies. Putting these requirements in the smoke proof enclosure requirements would create confusion. The code is clear right now regarding what protection is required outside of elevator hoistways and machine rooms and those areas are already protected. This would lead to subjective application of the code. (Vote: 13-1)

Assembly Motion: **NONE**

G146-18

Committee Action: **Approved as Submitted**

Committee Reason: This is a necessary change for correlation based on previous committee actions on the tall wood provisions. (Vote: 14-0)

Assembly Motion: **NONE**

G147-18

Committee Action: **Approved as Modified**

Committee Modification:

3103.1 General. The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. ~~Tents~~ Special event structures, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the International Fire Code. Those erected for a longer period of time shall comply with applicable sections of this code.

Committee Reason: The committee approved the modification as it alleviated concerns regarding temporary structures. The committee approved the proposal based on the proponent's reason statement. (Vote: 14-0)

Assembly Motion: **NONE**

G148-18

Committee Action: **Approved as Submitted**

Committee Reason: Based on the proponents published reason and the fact that this proposal clarifies the code. (Vote: 13-1)

Assembly Motion: **NONE**

G149-18

Committee Action: **Disapproved**

Committee Reason: This proposal has some merit, but the language is too loose. "Public" could mean any building that is considered public in the Americans with Disabilities Act. "Governmental entities" may be a better term. (Vote: 9-

Bibliography: The ANSI standard is already referenced in the IFC and is widely available.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change merely correlate standards and reflects the State of the practice.

Public Comment 2:

IBC@: (New), 1609.1.1, 1613.1, 3103.1, 3103.1.1, 3103.5 (New), 3103.6 (New), ASCE/SEI Chapter 35 (New), ESTA (New)

Proponents:

Richard Nix, representing Entertainment Services and Technology Association (ESTA), and Event Safety Alliance (ESA) (rnix@zoomtown.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Building Code

~~**TEMPORARY SPECIAL EVENT STRUCTURE.** Any temporary ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower supporting audio or visual effects equipment or similar structures.~~

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. ~~Temporary special~~ Special event structures complying with Section 3103.5.5.

The wind speeds in Figures 1609.3(1) through 1609.3(8) are basic design wind speeds, V , and shall be converted in accordance with Section 1609.3.1 to *allowable stress design* wind speeds, V_{asdh} , when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S , is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. ~~Temporary special~~ Special event structures complying with Section 3103.5.

3103.1 General. The provisions of Sections 3103.1 through ~~3103.4~~ 3103.5 shall apply to structures erected for a period of less than 180 days. Tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall comply with the International Fire Code. Those erected for a longer period of time shall comply with applicable sections of this code.

3103.1.1 Conformance. Temporary structures and uses shall conform to the structural strength, ~~durability~~, fire safety, *means of egress*, accessibility, light, *ventilation* and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

3103.5 Structural. The structural design for temporary structures shall comply with the requirements in Chapter 16. ~~Temporary special~~ Special event structures erected outdoors for a period of not more than six consecutive weeks shall be designed and erected to comply with requirements of ESTA-ANSI E1.21 as well as the lateral forces in ASCE 37.

3103.6 Durability and maintenance. A qualified person shall inspect ~~temporary special event structures~~, including components, when purchased or acquired and at least once per year, based on the requirements in ESTA-ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the building official. Additionally, ~~temporary special event structures~~ shall be inspected at regular intervals when in service to ensure that the structure continues to perform as designed and initially erected.

37-14: Design Loads on Structures during Construction

ESTA

Entertainment Services and Technology
Association
630 Ninth Avenue, Suite 609
New York NY 10036
US

ANSI E1.21—2013: ~~Entertainment Technology: Temporary Ground-Supported Overhead Structures Used to Cover the Stage Areas and Support Equipment in the for Technical Production of Outdoor Entertainment Events~~

Commenter's Reason: 1. The proposed definition is not necessary because a new definition for "Special Event Structure" has already been approved for inclusion in the IBC as a result of CCP G147-18.

2. Revise the proposed change to 1609.1.1 exception 7 to use the defined term as per CCP G147-18, and to correct an editorial reference to the newly proposed section 3103.5

3. Revise the proposed change to 1613.1 exception 6 to use the defined term as per CCP G147-18.

4. Revise existing wording in section 3103.1 to be inclusive of the newly proposed section 3103.5

5. Revise the proposal such that NO CHANGE is made to the existing wording of section 3103.1.1

6. Revise the wording of the proposed new section 3103.5 to use the defined term approved as a result of CCP G147-18, and to remove the proposed reference to ASCE 37-14.

7. Delete the proposed section 3103.6 from the proposal. It is not necessary. Inspections are addressed in ANSI E1.21.

8. Delete the proposed reference to ASCE/SEI 37-14.

The single objection made during CAH indicated that ASCE 37-14 is not intended to be used for temporary structures, yet it is interesting to note that its scope and associated commentary for Chapter 6 are clear that it is for use with temporary structures, as shown in the ASCE 37-14 commentary text:

*This section deals with special issues of construction **and temporary structures for which the basic procedures of ASCE 7-10 (ASCE/SEI 2010) are to be modified.***

*The environmental loads in this chapter are reduced from those in ASCE 7-10 in recognition of the anticipated lifespan of **temporary structures** and temporary configurations of structures under construction. Reduction to the safety of individuals is not the intent of the committee.*

*Reductions of loads to the levels stated in this standard **are appropriate when loading situations can be managed through safety protocols** that limit access to hazardous locations when loadings exceed those used for temporary designs, and when loadings, including environmental loadings, can be limited (e.g., by timely snow removal) proactively. The knowledge and training of personnel in control of construction sites, the visible nature of construction elements, and the processes on construction sites are key components of protocols necessary to control of risk to personnel and property on the construction site. Risks to personnel and property adjacent to the construction site also warrant attention.*

There is a clear distinction between "construction" and "temporary structures", though the principles used to support load reductions based on duration of exposure are exactly the same. It is also interesting to note that the structures covered by ASCE 37-14 include scaffold and shoring structures, such as those used during construction of buildings and renovation of existing buildings, where they might be built over sidewalk areas that are accessible to the public. Arguments made during the CAH included assertions that ASCE 37-14 is to be used only when personnel are trained, which is also clearly addressed in ANSI E1.21 as part of its Operations Management Plan requirements. This comment asks to remove that reference from the proposal in order to alleviate that concern.

9. Revise the title of the referenced ANSI Standard as indicated. The ANSI designation is correct, but the title has been incorrectly transcribed into the ICC references. The standard (ANSI E1.21-2013) is an approved reference. (see staff note)

General commentary:

This proposal satisfies a stated ICC goal to attain better correlation between IFC and IBC. These structures have been important topics for the last two code cycles, as evidenced by the major overhaul of IFC Chapter 31 to accommodate special events and their associated structures. However, the IFC cannot adequately address structural requirements, so the simple changes requested by the proposal are necessary to better achieve overall coverage. Guidance for these structures has - until now - been essentially non-existent, so any review and approval under code purview can only be accomplished using the "Alternative Methods" approach, which drastically increases the amount of time, paperwork and resources necessary to validate conformance. This proposal reduces the amount of time and resources required to properly review and approve the structures, by introducing a recognized reference standard, ANSI E1.21, that has been an approved, consensus developed standard since 2006. It contains structural design requirements, it has been, and is now, widely used in the structural engineering community, among those who perform work on these types of structures. Many of the engineers who developed and use this standard also testified in support of the proposal at the CAH.

Questions arose during CAH testimony regarding inspections. The intent is to require inspections, however the further intent is to allow the code official the flexibility to designate who is authorized to perform such inspections. In cases where the jurisdiction has such resources, they would perform the inspection as usual, but in jurisdictions where they do not have such resources it is acceptable and reasonable to designate a 3rd-party inspector. This is addressed in ANSI E1.21. Questions also arose during CAH regarding "who is responsible". ANSI E1.21 is explicit about the responsibilities of the "designated person", who must meet the following criteria in accordance with the requirements of ANSI E1.21:

- ...has overall responsibility on-site for the temporary structure;
- ...shall have knowledge of the engineering documentation for the temporary structure's components and configurations in use;
- ...shall develop a risk assessment plan for each use, and shall provide instruction for the safe erection, use and dismantling of the temporary structure.

- ...shall prepare layout drawings consistent with the engineering documentation.

It was clear from the number and types of questions asked during the CAH that the committee was generally receptive to the proposal's intent of treating temporary structures for special events differently, and agreed that there was a deficiency in the code relating to the proposal's subject matter. Of greater importance is the reality that the number and size of special events in general - particularly those with structures - is growing significantly. The impact of this growth is clearly recognized in the current IFC's expansion of its Chapter 31 scope and coverage.

For Reference CCP G147:

- IBC Definitions - Temporary Special Event structures IBC: 3103.1, 202 (New) Proponent: Richard Nix, representing Entertainment Services & Technology Association/Event Safety Alliance (rnix@zoomtown.com) 2018 International Building Code 3103.1 General. The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. Tents, special event structures, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the International Fire Code. Those erected for a longer period of time shall comply with applicable sections of this code. Add new definition as follows: SPECIAL EVENT STRUCTURE. Any ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower or similar structure supporting entertainment-related equipment or signage. Reason: These structures are covered under the scope of IBC Chapter 31, Special Construction. IBC Section 3103 addresses installations <180 days, which are considered "temporary". Temporary tents, any type of membrane covered structure and special events structures are therefore within the scope of IBC Chapter 31, section 3102 and/or section 3103. All of these structures except special event structures are referred to IFC Chapter 31. The IFC has added new requirements in Chapter 31 for special events structures, therefore special event structures must also be referred from IBC Chapter 31 to IFC Chapter 31. Building Code Officials and others using the IBC as a primary code reference require the proper guidance and direction to IFC Chapter 31. In the last code change cycle, F308-16 replaced the IFC term temporary stage canopy with the term temporary special events structure. Therefore, Temporary special events structures are now covered under the purview of IFC Chapter 31. Coordination with IBC Chapter 31 was both implied and intended to occur as a result of F308-16, due to the special construction and temporary characteristics of these structures. However, that coordination did not occur. This CCP ensures proper coordination between IFC and IBC as intended in the last code change cycle. This proposed definition for Special Events Structures in IBC is slightly different than that used in IFC, because the word "temporary" is implied by the corresponding IBC section 3103, where these structures are currently mentioned. Cost Impact The code change proposal will not increase or decrease the cost of construction. The proposed change adds a definition for clarity along with a pointer for code coordination.

Please support the change proposal and this public review comment.

Bibliography: ANSI E1.21 is already an approved reference standard in the IFC. It is available for free download at https://tsp.esta.org/tsp/documents/published_docs.php

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This proposal decreases the cost of construction by reducing or eliminating the need for additional time and resources necessary to validate an Alternate Methods design approach, by providing clear guidance to appropriate reference standards.

Public Comment# 2092

RB1-19

IRC@: R104.11, R104.11.1 (New), R104.11.1.1 (New), R104.11.2, R106.3.1.1 (New), 202 (New)

Proposed Change as Submitted

Proponents: Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

2018 International Residential Code

R104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The *building official* shall have the authority to approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The *building official* shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Compliance with the specific performance-based provisions of the International Codes shall be an alternative to the specific requirements of this code. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Add new text as follows:

R104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved sources*.

R104.11.1.1 Approved sources. Agencies conducting product certification or product evaluation shall be accredited by an accreditation body. The scope of accreditation shall include the acceptance criteria referenced in the research report, for the research report to be accepted for product approval.

Revise as follows:

~~**R104.11.2 Tests.**~~ Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made at no expense to the *jurisdiction*. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved* agency. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

Add new text as follows:

R106.3.1.1 Third-party certification. Products and materials required by the code to be in compliance with a referenced standard shall be *certified* by a *third-party certification agency* as complying with the referenced standards. Products and materials shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

Add new definition as follows:

ACCREDITATION BODY. An approved, third-party organization that is independent of the grading, product certification and inspection agencies that initially accredit and subsequently monitors agencies conducting building product certification or evaluation schemes on a continuing basis, including the competency and performance of a grading or inspection agency related to carrying out specific tasks.

Reason: The standard practice in building products conformity assessment involves accreditation of the agencies by an accreditation body such as ISO. Third party testing, manufacturing inspections and product certification or product evaluation provide a higher level of quality assurance on these activities for the building official. Approved sources that issue research reports must be accredited to the specific acceptance criteria referenced in the research report. This ensures that the approved sources have the requisite technical expertise and experience to conduct such activities on behalf of the building official. Harmonized language is proposed for inclusion a new Section R106.3.1.1 regarding third-party certification, and in Chapter 2 with a definition for accreditation body. A definition for Third-Party Certification Agency already exists in the IRC and remains unchanged. The language in the new Section R106.3.1.1 is identical to language in the International Plumbing Code Section 303.4. The added definition is the same as that proposed for inclusion in the International Building Code. These additions will improve the consistency and intent of the I-codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal coordinates the codes.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This would require every product to have a listing with a large cost impact. Some standards do not require testing. Every engineer and agency would require certification. This would limit innovation. This hamstring the ability of code officials to approve alternatives. The code official already has the right to choose what credentials are required in Section R104.9 so this proposal is unnecessary. (Vote: 11-0)

Assembly Action:

None

RB1-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R104.11.1.1 (New), R106.3.1.1 (New)

Proponents:

Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R104.11.1.1 Approved sources for product certification or product evaluation.** Agencies conducting product certification or product evaluation shall be accredited by an accreditation body. The scope of accreditation shall include the acceptance criteria referenced in the research report, for the research report to be accepted for product approval. Product certification and product evaluations shall be performed by agencies that are accredited by an accreditation body or shall be performed by registered design professionals. The scope of accreditation shall include the standard or acceptance criteria referenced in the research report, for the research report to be accepted for product approval.~~

~~**R106.3.1.1 Third-party certification.** Products and materials required by the code to be in compliance with a referenced standard shall be certified by a third-party certification agency as complying with the referenced standards. Products and materials shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.~~

Commenter's Reason: Comments were received that the section "Approved Sources" conflicts with the definition of "Approved Source" elsewhere in the code. The section title was revised and clarified to pertain specifically to agencies conducting product certification and product evaluation.

Comments were received that in some cases, registered design professionals may already do product certification or product evaluation for certain types of building products. The text was revised to include registered design professionals.

Comments were received that the term "acceptance criteria" was limiting. This is not the case, as the term "acceptance criteria" already appears many times throughout the code, and the meaning is well understood. "Standards" were added alongside "acceptance criteria", as research reports may be based on standards or acceptance criteria.

Comments were received that requiring third-party certification by third-party certification agencies would create an undue burden and was not necessary for all building products in the code. The third-party certification requirement is consequently deleted. The definition for third-party certification agency is currently in the code and shall remain.

The new definition for "Accreditation Body" is consistent with the revised definition in ADM23-19 Part II.

For the reasons above, we strongly encourage overturning the committee and approving the code change as modified by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment removes the requirement for third party certification.

Public Comment# 1469

Proposed Change as Submitted

Proponents: Lee Schwartz, representing Self (lee@hbaofmichigan.com)

2018 International Residential Code

Revise as follows:

R105.2 Work exempt from permit. Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*. *Permits* shall not be required for the following:

Building:

1. One-story detached *accessory structures*, provided that the floor area does not exceed 200 square feet (18.58 m²).
2. Fences ~~not over 7 feet (2134 mm) high.~~
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
5. Sidewalks and driveways.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Prefabricated swimming pools that are less than 24 inches (610 mm) deep.
8. Swings and other playground equipment.
9. Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
10. Decks not exceeding 200 square feet (18.58 m²) in area, that are not more than 30 inches (762 mm) above *grade* at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.

Electrical:

1. *Listed* cord-and-plug connected temporary decorative lighting.
2. Reinstallation of attachment plug receptacles but not the outlets therefor.
3. Replacement of branch circuit overcurrent devices of the required capacity in the same location.
4. Electrical wiring, devices, *appliances*, apparatus or *equipment* operating at less than 25 volts and not capable of supplying more than 50 watts of energy.
5. Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical *equipment* to *approved* permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying *appliances*.
2. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
3. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Mechanical:

1. Portable heating *appliances*.
2. Portable ventilation *appliances*.
3. Portable cooling units.
4. Steam, hot- or chilled-water piping within any heating or cooling *equipment* regulated by this code.

5. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
6. Portable evaporative coolers.
7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.
8. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

Reason: The International Residential Code contains no definition of “fence”, no listing of “fence” in the index and no sections or subsections specifically governing the material, design or method of construction for a fence. In short there are no specific code requirements for fences found in the International Residential Code. This leaves permit applicants to searching in vain thorough the entire IRC to find requirements for the construction of a fence when none exist. It also places inspectors in the unenivable position of having to inspect fences for which a permit was pulled without any criteria for approving the fence construction. How can a building official write a violation notice when there are no pertinent requirements to base the notice on?

While the IRC does contain an exemption for fences not over 7 feet high. This is an arbitrary number chosen for convenience and without without any data to back it up. Is a fence that is 7 feet two inches inherently more dangerous to the publis health, safety and general welfare than a fence that is 6 feet 11 1/2 inches?

The purpose of the code is to establish minimum requirements to safeguard the public safety, health and general welfare. Mandating the issuance of a construction permit for fences when no minimum requirements are specifically present in the code book does not safeguard the public safety, health and general welfare.

Requiring a permit for a fence, even with the under seven feet exeption, simply because the code states you must have a permit aqnd without any standards is exactly the type of overreach which leads to people not pulling permits on other, more critical, construction.

In most jurisdictions, requirements for fences have been treated as a zoning issue with zoning ordinances controlling the size, type, materials and manner of construction for a fence. The requirement for a fence permit should be totally removed from the IRC and left to local zoning.

Cost Impact: The code change proposal will decrease the cost of construction by eliminating an unnecessary permit and the fee for that permit.

RB2-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: There are no prescriptive requirements in the IRC for fences. This exempts requirements for permits. It does not exempt code requirements. If something needs to be regulated by the code, the code official still has the authority. It just exempts inspections. Many jurisdictions regulate fences over a certain height and that is a local issue.

In opposition: In some jurisdictions, fences are usually built of masonry and are very heavy and present structural concerns. This could allow tall fences without permits. Fences in general would be more appropriately addressed by zoning or municipal engineering requirements and the IRC is not the place to address them.

(Vote: 6-4)

Assembly Action:

None

RB2-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R105.2, 202 (New)

Proponents:

J Daniel Dolan, representing Federal Emergency Management Agency/ Applied Technology Council Seismic Codes Support Committee (jddolan@wsu.edu); Kelly Cobeen, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R105.2 Work exempt from permit. Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*. *Permits* shall not be required for the following:

Building:

1. One-story detached *accessory structures*, provided that the floor area does not exceed 200 square feet (18.58 m²).
2. Fences not more than 8 feet (2400 mm) in height and weighing not more than 5 psf.
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Free standing walls, not supporting a surcharge, that are 4 ft (1220 mm) or less in height as measured from the top of the wall to the lowest adjacent grade.
- ~~4-5.~~ Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
- ~~5-6.~~ Sidewalks and driveways.
- ~~6-7.~~ Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
- ~~7-8.~~ Prefabricated swimming pools that are less than 24 inches (610 mm) deep.
- ~~8-9.~~ Swings and other playground equipment.
- ~~9-10.~~ Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
- ~~10-11.~~ Decks not exceeding 200 square feet (18.58 m²) in area, that are not more than 30 inches (762 mm) above *grade* at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.

Electrical:

1. *Listed* cord-and-plug connected temporary decorative lighting.
2. Reinstallation of attachment plug receptacles but not the outlets therefor.
3. Replacement of branch circuit overcurrent devices of the required capacity in the same location.
4. Electrical wiring, devices, *appliances*, apparatus or *equipment* operating at less than 25 volts and not capable of supplying more than 50 watts of energy.
5. Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical *equipment* to *approved* permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying *appliances*.
2. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.

3. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Mechanical:

1. Portable heating *appliances*.
2. Portable ventilation *appliances*.
3. Portable cooling units.
4. Steam, hot- or chilled-water piping within any heating or cooling *equipment* regulated by this code.
5. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
6. Portable evaporative coolers.
7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.
8. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

[RB] FREESTANDING WALL. A man-made structure built of rock, block, timber, concrete or similar material that does not directly support retained material or serve as a facing of a cut slope. This definition does not include standard wooden privacy fences as used in residential applications.

Commenter's Reason: This public comment adds a new definition to differentiate free standing walls from fences. By doing this, the fences that were the concern of the original proponent will not require a permit until they exceed eight feet, thereby allowing most common residential fences. The free standing walls that present a higher earthquake hazard will require permits when over four feet and constructed of heavier materials. This will help to protect the safety of the dwelling occupants and pedestrians. In most moderate to major earthquakes extensive damage to, and collapse of, free standing walls is observed. The photos below are of partially collapsed six foot high walls in the recent Searles Valley (Ridgecrest) Earthquake. This is an example of a common residential free standing wall that could cause harm.





Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This change will probably increase the cost of construction for heavy walls, but the increase in design and inspection will also improve the safety and durability of the walls.

Public Comment# 1464

RB5-19

IRC@: 202 (New)

Proposed Change as Submitted

Proponents: Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

2018 International Residential Code

Add new definition as follows:

BUILDING DESIGNER. The owner of the building or the person that contracts with the owner for the design of the building structural system or who is responsible for the preparation of the construction documents. Where required by the statutes of the jurisdiction in which the project is to be constructed, the building designer shall be a registered design professional.

Reason: The title "building designer" is currently used twice within the IRC, in Section R502.11.4 and Section R802.10.1. In each of the two sections, "building designer" refers to a person who is qualified and responsible for designing the size, connections, and anchorage of the permanent continuous lateral bracing. Therefore, a definition of the title providing the qualifications of the individual is necessary. Furthermore, nearly every State allows for individuals other than "registered design professionals" to prepare construction drawings for those buildings covered under the scope of the IRC. Therefore, it is essential to the correct interpretation of the code that the title "building designer" is clarified by definition to avoid potential confusion and misinterpretation of the actual qualifications and prerequisites required of those individuals given the responsibility to design one- and two-family dwellings and townhouses.

Standard ANSI/TPI 1 includes a definition of "building designer" and this proposal largely mirrors the ANSI/TPI 1 definition with a small deviation to remain consistent with verbiage in Section R106.1.

Standard ANSI/TPI 1 is a nationally developed consensus standard referenced by the IRC. Therefore, it makes logical sense to include the currently accepted definition of "building designer" for clarity, for consistency, and to avoid referencing two separate documents for the same information.

References:

"ANSI/TPI 1, 2.2 Definitions:

***Building Designer:** The owner of the building or the Person that contracts with the Owner for the design of the Building Structural System and/or who is responsible for the preparation of the Construction Documents. When mandated by the Legal Requirements, the Building Designer shall be a Registered Design Professional."*

"Section R106.1 Submittal Documents

...The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed..."

"R502.11.4 Truss design drawings.

*11. Maximum axial compression forces in the truss members to enable the **building designer** to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss drawing or on supplemental documents."*

"R802.10.1 Truss design drawings.

*11. Maximum axial compression forces in the truss members to enable the **building designer** to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents."*

Bibliography: ANSI/TPI 1 - 2014, August 27, 2014, Truss Plate Institute, Alexandria, VA

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not change the current practice of building design, or who is qualified to perform the task.

RB5-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The second sentence is unnecessary. This definition is already covered in the definition of registered design professional. This would create potential conflicts with the IRC and state laws. This is confusing and needs work. (Vote: 9-2)

Assembly Action:

None

RB5-19

Individual Consideration Agenda

Public Comment 1:

IRC@: 202 (New)

Proponents:

Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

BUILDING DESIGNER. ~~The owner of the building or the person that contracts with the owner~~ responsible for the design of the building's structural system or ~~who is responsible for the preparation of the construction documents. Where required by the statutes of the jurisdiction in which the project is to be constructed, the building designer shall be a registered design professional.~~

Commenter's Reason: This proposal has been reworded in an effort to address the following concerns expressed by the committee upon disapproval.

- The second sentence is unnecessary.
- This is confusing and needs work.

However, I strongly disagree with the committee's position that, "This definition is already covered in the definition of a *registered design professional*." On the contrary, **this definition focuses on the function of an individual** rather than referencing only statutory requirements, which is what the definition of a *registered design professional* does.

Moreover, although both titles are used within the IRC, a *registered design professional* may be a *building designer*, but a building designer **may not have to be a registered design professional**. This is a distinct difference and this proposal is intended to make it clear that when the title *building designer* is used, the latter scenario may typically be the case.

I also disagree with the committee's statement, "This would create potential conflicts with the IRC and state laws." This is an example of the confusion, or bias, within the industry that this proposal seeks to clarify. Nearly every state statute allows for **persons other than registered design professionals** to design single-family dwellings, townhouses covered by the IRC are also included in the majority of states. Section 106.1 of the IRC recognizes this.

The American Institute of Building Design encourages the approval of this submittal as modified by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. There is no cost impact, the intent of the proposal is to provide clarification, only.

Public Comment# 1803

RB7-19

IRC@: [RB] 202

Proposed Change as Submitted

Proponents: Lucas Pump, representing Self (l.pump@cedar-rapids.org)

2018 International Residential Code

Revise as follows:

[RB] **CRAWL SPACE.** An unfinished underfloor space that is not a basement.

Reason: The current definition for "crawl space" is too broad. According the current definition, I could walk into the main level of a 2-story house, and stand in the living room, and I could call that area a "crawl space". I would be under the floor of the second floor, and not in a basement, but I believe that we could all agree that this 1st floor is not a "crawl space". So, adding this additional language helps define the space better.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is just clarification of the definition, and should not have a cost impact.

RB7-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee is unsure what the term "unfinished" means. The proposal is not consistent with the intent indicated in the proponent's reason statement. (Vote: 11-0)

Assembly Action:

None

RB7-19

Individual Consideration Agenda

Public Comment 1:

IRC@: [RB]

Proponents:

Lucas Pump, representing Self (l.pump@cedar-rapids.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] **CRAWL SPACE.** An ~~unfinished~~ underfloor space that is not a basement and is not habitable space.

Commenter's Reason: After listening to the reason from the Committee Action Hearings, I believe that this change to "is not habitable space" is better than "unfinished". The primary reason was that the committee didn't like "unfinished" because to was not well defined. But, I think "not habitable space" would put the area into a category of a normally unoccupied and/or uninhabitable space which is currently well defined. As stated previously, the current definition for "crawl space" is too broad. According the current definition, I could walk into the main level of a 2-story house, and stand in the living room, and I could call that area a "crawl space". I would be under the floor of the second floor, and not in a basement, but I believe that we could all agree that this 1st floor is not a "crawl space". So, adding this additional language helps define the space better.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is just clarification of the definition which is currently very vague, and should not have a cost impact.

RB10-19

IRC@: [RB] 202

Proposed Change as Submitted

Proponents: Thomas Meyers, representing Self (codeconsultant@gmail.com)

2018 International Residential Code

Revise as follows:

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.
3. ~~To an imaginary line between two buildings on the lot.~~

The distance shall be measured at a right angle from the face of the wall.

Reason: The definition for fire separation distance is identical to that in the IBC. Unlike the IBC, the IRC does not have a requirement to use an "imaginary line" for fire separation distance assessment. It's retention in the definition creates confusion and should therefore be eliminated.

Cost Impact: The code change proposal will decrease the cost of construction
Elimination of unnecessary and confusing language may result in cost reductions where the imaginary line was erroneously applied.

RB10-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are many cases where we basically eliminate fire separation distance requirements for dwelling units, accessory buildings, etc. But we do get multiple IRC buildings and sometimes IBC mixed uses on the same lot and without the concepts of fire separation distance and "imaginary line" the code does not work. No workable alternative has been provided. The original language provides a level of safety for multiple buildings on the same lot. (Vote: 11-0)

Assembly Action:

None

RB10-19

Individual Consideration Agenda

Public Comment 1:

IRC@: [RB] 202, R302.1, R302.1.1 (New)

Proponents:

David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.

3. To an imaginary line between two buildings on the lot.

The distance shall be measured at a right angle from the face of the wall.

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwelling*s and accessory buildings shall comply with Table R302.1(1); or *dwelling*s equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

R302.1.1 Buildings on the same lot. For the purposes of determining *fire separation distance* and the requirements of Section R302.1, buildings on the same *lot* shall have an imaginary line established between them. Imaginary lines shall extend to a *lot line* or to another imaginary line.

Where a new building is to be erected on the same *lot* as an existing building, the location of the imaginary line with relation to the existing building shall be such that the existing building meets requirements of Section R302.1.

Commenter's Reason: The discussion during the committee action hearings was that there is a need to to keep the imaginary line concept in the definition of fire separation distance. Imaginary lines are necessary to establish exterior wall requirements between buildings on a lot such as two (or more) dwellings or two (or more) buildings containing townhouse units. Because of this, the original proposal to delete the imaginary line concept was appropriately disapproved by the committee. However, the hearing discussion made it apparent that there is a need to add requirements in the body of the code for establishing imaginary lines. This public comment maintains the imaginary line concept in the definition of fire separation distance and provides a new sub-section in the code to dictate where and how to establish imaginary lines. Also, this public comment addresses the condition where a new building is added to an existing lot - this is needed so a new building doesn't cause an existing building to become non-compliant with regard to fire-resistant exterior wall requirements.

It should be noted that Exception 2 to Section R302.1 (which is included in this public comment for reference only) exempts walls between dwelling units and their accessory structures from fire-resistant exterior wall requirements and this public comment does not change this. Even though an imaginary line is established between these buildings, Exception 2 still applies and the imaginary lines are not used.

I urge your support of this public comment that brings clarity to the code by adding requirements for establishing imaginary lines between buildings on the same lot. This is an improvement that will bring consistent interpretation and enforcement of fire-resistant exterior wall requirements for buildings on the same lot.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment simply clarifies current code requirements, so there should be no change in the cost of construction.

RB11-19

IRC@: (New)

Proposed Change as Submitted

Proponents: Donald Sivigny, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Add new definition as follows:

[RB] Flashing. A non-corrosive, water-resistant material, installed to resist water entry, and direct water away from or out of the building assembly.

Reason: There is a need to prevent water from seeping in and causing damage to the home's walls, ceilings and other assemblies. This water is causing structural damage to the home, or creating moisture and mold problems throughout the home. This form of protection is a necessary construction practice, and it's widely applied to commercial, residential and industrial structures within the industry. Therefore, there is a need to define flashing

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no Cost Impact with this Change

RB11-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is no qualification for water resistance. This proposal conflicts with Section R507.2.4, which requires "metal." The committee encourages the proponent to work on the application of other materials. (Vote: 11-0)

Assembly Action:

None

RB11-19

Individual Consideration Agenda

Public Comment 1:

IRC@: (New)

Proponents:

Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] Flashing. A ~~non-corrosive~~ corrosion-resistant, water-resistant material or system, installed to resist water entry, and direct water away from or out of the building assembly.

Commenter's Reason: The term "flashing" appears over in 50 sections of the IRC. As described in these sections of the code, flashing is required to prevent water from entering the interior of a building at roof/wall penetrations, the perimeter of windows and doors, etc. Traditionally, flashing is thought of as metal. However, innovation has brought to the market non-metal flashings such as butyl and acrylic tapes and liquid-applied products that meet the criteria for preventing water penetration. The use of a combination of materials has resulted in flashing systems, in which the individual components are tested along with the entire system and found to meet the applicable performance criteria.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This is simply adding a definition where none existed before, without creating any new technical requirements at all.

Public Comment# 1809

RB14-19

IRC@: [RB] 202 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

[RB] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. ~~A window or other~~ An emergency and escape and rescue opening located such that the ~~sill~~ height of the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening. (See also "Emergency escape and rescue opening.")

Reason: This definition is used only in Section IRC R310.2.1. The change to the definition is so it matches how it will be used in the technical criteria. What is a 'sill' is not clear – the modification is for consistency with technical criteria. It is important to indicate that this is to the bottom of the opening (otherwise a below grade window could be very deep). See also revisions to IRC R310.2.1. There was a similar proposal approved for Group A for IBC - G4-18(AS).

This is one of a series of proposals to coordinate the requirements for emergency escape and rescue openings in the IBC and IRC. While independent issues, if all the proposals are approved, the IRC section would appear as indicated in the reason for the proposal to revise the definition – emergency escape and rescue openings.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is a coordination item for requirements for EEROs already permitted between the codes.

RB14-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The language change in the definition needs to be changed in the body of the code as well in each instance it occurs. This is a good concept that could be addressed in the public comment period. (Vote: 11-0)

Assembly Action:

None

RB14-19

Individual Consideration Agenda

Public Comment 1:

IRC@: [RB], [RB] 202 (New), R310.2, R310.2.1

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or similar device that provides for a means of escape and access for rescue in the event of an emergency. (See also “Grade floor emergency escape and rescue opening.”)

[RB] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. An emergency escape and rescue opening located such that the height of the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening. (See also “Emergency escape and rescue opening.”)

R310.2 Emergency escape and rescue openings. Emergency escape and rescue openings shall have minimum dimensions as specified in this section.

R310.2.1 Minimum opening area. Emergency and escape rescue openings shall have a net clear opening of not less than 5.7 square feet (0.530 m²). The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. The net clear height of the opening shall be not less than 24 inches (610 mm) and the net clear width shall be not less than 20 inches (508 mm).

Exception: *Grade floor emergency escape and rescue openings or below-grade openings* shall have a net clear opening area of not less than 5 square feet (0.465 m²).

Commenter's Reason: This public comment addresses the concern the code committee had at the Committee Action Hearings held in Albuquerque NM by revising the defined term in the other two locations of the IRC where the term exists. This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is a coordination item for requirements for EEROs already permitted between the codes.

Public Comment# 1246

RB20-19

IRC@: (New)

Proposed Change as Submitted

Proponents: Donald Sivigny, State of Minnesota, representing State of MN and Association of Minnesota Building Officials
(don.sivigny@state.mn.us)

2018 International Residential Code

Add new definition as follows:

PORCH. An open, screened, or glazed, one story portion of a building that is separated by a thermal envelope, and has a space conditioning system exceeding 3.4 Btus or 1 watt of energy use at peak operation, or that is capable of being shut off without shutting off the space conditioning system to other areas of the building.

Reason: *There is no industry standard language as to what a porch is defined as. Many times a deck becomes a porch and then actually becomes conditioned space. The code does define decks and conditioned spaces but not a porch. Therefor there is a need for a definition of what a porch actually is. This language is very similar to the same language used to define a sunroom, in the code with some modifications*

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change proposal will not increase the cost of construction and may actually decrease the costs because it creates a consistent definition of what a porch is, no longer do the code official and builder need to guess how it is going to be permitted, defined and built or what are the code requirements that need to be met.

RB20-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The changes in this proposal are not necessary. Definitions should not contain requirements. All porches are not conditioned.
(Vote: 11-0)

Assembly Action:

None

RB20-19

Individual Consideration Agenda

Public Comment 1:

IRC@: (New)

Proponents:

Ann Houske Jacklitch, representing AMBO IRC Code Committee (ajacklitch@maplegrovern.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

PORCH. ~~An open, screened, or glazed, one story unconditioned portion of a building, that is separated by a thermal envelope, and has a space conditioning system exceeding 3.4 Btus or 1 watt of energy use at peak operation, or that is capable of being shut off without shutting off the space conditioning system to other areas of the building.~~

Commenter's Reason: We have removed the references to conditioned spaces and number of stories. Conditioned spaces are regulated as additions or sunrooms, rather than as porches, and porches can be multi-story.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change proposal will not increase the cost of construction and may actually decrease the cost because it creates a consistent definition of what a porch is.

Public Comment# 1523

RB22-19

IRC@: [RB] 202

Proposed Change as Submitted

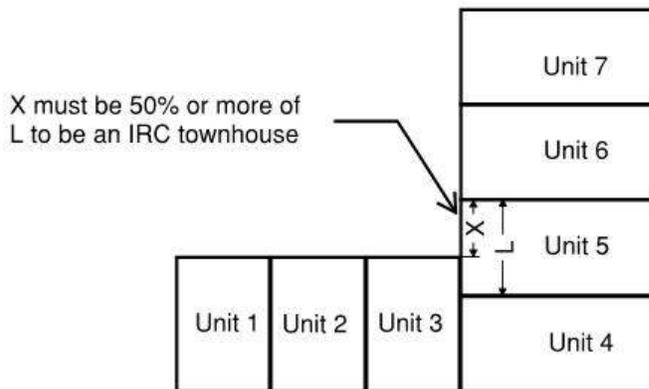
Proponents: David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

2018 International Residential Code

Revise as follows:

[RB] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and ~~with~~ has a yard or public way on not less than two sides that extends at least 50 percent of the length of each of these two sides.

Reason: The definition of "townhouse" requires a yard or public way on not less than two sides, which is intended to provide some degree of independence from the other townhouse units in a building; however, the definition does not dictate the length required for the yard or public way. This proposal requires a minimum of 50% of the length of a side to have a yard or public way, which is a reasonable amount to provide the degree of independence intended and to provide fire department access. There is a need for this requirement as configurations of townhouses can create situations with a side that has a relatively small proportion of the wall length that has a yard or public way; for example, townhouses that are configured around the corner of a townhouse building per the drawing below.



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal provides a clarification to the current code requirements so it should not increase or decrease the cost of construction.

RB22-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal has some good ideas, but needs further development. (Vote: 11-0)

Assembly Action:

None

RB22-19

Individual Consideration Agenda

Public Comment 1:

IRC@: [RB] 202, R302.2

Proponents:

David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and has a yard or public way on not less than two sides ~~that extends at least 50 percent of the length of each of these two sides.~~

R302.2 Townhouses. Townhouse units shall have a yard or public way on the entire projected length of one of the four principal sides and on at least two-thirds of the projected length of another principal side. Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.

Commenter's Reason: The committee agreed there was a need to address the issue raised in the original proposal and requested that this come back at the public comment hearings. The intent of this public comment is to improve on the original proposal by addressing issues raised at the public comment hearings. This is accomplished as follows:

1. Many comments were made that requirements should not be in a definition. This public comment moves specific yard or public way requirements to the R302.2 Townhouses section and keeps the definition of townhouse as it currently is. An additional benefit to this approach is that the definition of townhouse in the IRC and the IBC remain to be very similar.

2. The original proposal required a yard or public way on a minimum of 50% of each open side. This is changed to the entire projected length of one principal side and at least two-thirds of the projected length of another side. Two-thirds is a compromise between the 50% originally proposed and the 80% proposed in a floor modification at the committee action hearings. The entire length of one side was added since it was pointed out that two partially open sides could result in a unit that is too "boxed in", creating more hazard from adjacent units than intended. I originally assumed one side would be fully open since this is the case almost all of the time, but configurations could have been used that reduced the openness on two sides.

3. Wording has changed from "length of sides" to "projected length of...principal sides". The intent is to avoid short jogs in the exterior wall from being counted as a "side". This is a major improvement over the current townhouse definition that only requires a yard or public way on two "sides", with no indication of what is considered to be a "side".

Please support this public comment to bring clarity to the openness requirements for townhouses. The current language in the code only requires a yard or public way on two sides with no minimum length requirements for the yards or public ways, making this largely open to interpretation. This public comment puts a hard requirement on the lengths of the yards or public ways which brings clarity and consistency for designers and building officials.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal provides a clarification to the current code requirements so it should not increase or decrease the cost of construction.

Public Comment# 1343

Public Comment 2:

IRC®: [RB] 202, R302.2, R302.2.1 (New), R302.2.2 (New)

Proponents:

Jeffrey Shapiro, International Code Consultants, representing IIAR (jeff.shapiro@intlcodeconsultants.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof ~~and has a yard or public way on not less than two sides that extends at least 50 percent of the length of each of these two sides.~~

R302.2 Townhouses. ~~Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.~~

R302.2.1 Open sides and adjoining units. Where a townhouse unit adjoins one or two other townhouse units, a yard or public way shall be provided on not less than two sides.

Where a townhouse unit adjoins three or more other townhouse units, all of the following shall apply:

1. The townhouse unit and adjoining townhouse units shall be equipped with automatic fire sprinkler systems in accordance with Section P2904.
2. Not less than 25 percent of the perimeter of each townhouse unit shall adjoin a yard or public way, distributed on two or more open sides
3. To be considered an open side, the minimum length of exterior wall adjoining a yard or public way shall be 3 feet.

R302.2.2 Separation walls. Walls separating townhouse units shall be constructed in accordance with Section R302.2.2.1 or R302.2.2.2.

Commenter's Reason: This comment builds on a floor modification that was presented at the code hearing, which received significant support. The committee generally commented favorably on the approach, but viewed the modification as too much to digest on the fly at the hearing. Conceptually, the idea is pretty straightforward. It is to better recognize the original concept of townhouses, which was built on rectangular row houses in a linear configuration, and also accommodate fourplexes that are made up of 4 corner units in a square or rectangle. In each of these cases, any townhouse unit is exposed to not more than two neighboring units. Over time, townhouse designers have gotten very creative with the concept of "sides" that adjoin a yard or public way, and odd shapes that have townhouse units adjoining 3 or more neighboring units with a variety of common wall schemes have evolved. What constitutes a "side" in such cases has led to disagreements between code officials and designers, and lacking guidance in the code, code officials have little to fall back on beyond "I'm the code official," and that puts the code official in a bad situation.

This comment maintains the current approach for townhouses that adjoin one or two other units because, in such cases, jogged walls that might otherwise "block" part of an open side tend to be less of a problem based on simpler geometry. No harm, no foul...the only change made by the comment for such situations is moving the yard/public way text out of the definition and into the body of the code because the current text regarding open sides puts a regulation into the definition, which is frowned upon.

The issue of open sides becomes much more pronounced when three or more units share walls. The approach taken in this comment, which reflects what the committee considered in the floor modification, is to regulate based on a percentage of total unit perimeter being open to a yard or public way. The requirement for fire sprinklers, technically always required by the IRC but not enforced in some jurisdictions, is appropriate because the risk of exposure to an adjacent unit on fire increases by 50% or more when you step from 2 adjoining units to 3 or more. With sprinklers being provided, the need for large open sides is reduced, and the intent of this change is to allow one or more of the open sides to be as small as 3 feet. This correlates with RB86-19 (approved at the code hearing), which clarified that emergency escape and rescue openings require a minimum of 36-inches of clear space between the opening and a public way.

The 25% figure is derived from a typical 20x30 townhouse and follows the logic that the front side might be entirely open and the back side partially to mostly blocked by another unit or units. Remember, none of that applies to townhouses adjoining only one or two other units. It only kicks in where 3 or more units are adjoined, and a designer always has the option of adjoining only one or two other units to avoid the limit if it becomes a problem for a narrow townhouse.

Although there is no "perfect" fix to this issue given the multitude of configurations that designers might come up with, this comment provides a fair, reasonable and flexible basis for quantifying a level of openness for townhouses that should be acceptable given the history of the townhouse provisions and interests of today's designers.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Technically, the IRC requires all buildings to be sprinklered, so this doesn't have a cost impact with respect to the model code. In jurisdictions that amend the IRC by removing the sprinkler requirement, there would be a cost increase if the habitable attic provisions were used.

Public Comment# 2086

RB25-19

IRC@: (New)

Proposed Change as Submitted

Proponents: Donald Sivigny, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Add new definition as follows:

WATERPROOFING. Treatment of a surface or structure that bridges nonstructural cracks, and is designed to resist the passage of water under hydrostatic pressure or through capillary action, which may penetrate the building assembly.

Reason: Damproofing in Section R406.1 is no longer commonly used in the code knowledgeable industry, as it is not an effective way to keep the buildings below grade foundation system, dry, durable and free from moisture and mold issues affecting homes and homeowners today. The typical damproofing, system will require additional steps such as parging, or other materials be applied to the foundation wall prior to the application of the damproofing product. This adds additional costs in materials and labor for the builder. This cost is passed along to the consumer. Knowledgeable builders of today understand the benefits of waterproofing and the overall cost savings in initial costs, and the reduction in costs associated with call backs and repairs of wet foundation systems. Therefore it is necessary to define waterproofing

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase the cost of construction as it is simply correcting the definition for clarity reasons. In fact this clarity may even reduce the costs of the code from delays that happen when code corrections are written for a specific job or building by more clearly defining what the code means by, Waterproofing . These delays caused by code corrections costs the builders money.

RB25-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The reason statement mentions structural cracks, but there are also other types of cracks. A definition of waterproofing may be needed, but this needs more work. Not all terms need a definition. This is already very well covered in Section R406.2. This term is not commonly misunderstood. (Vote: 10-1)

Assembly Action:

None

RB25-19

Individual Consideration Agenda

Public Comment 1:

IRC@: (New)

Proponents:

Ann Houske Jacklitch, representing AMBO IRC Code Committee (ajacklitch@maplegrovern.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

WATERPROOFING. Treatment of a surface or structure that bridges ~~nonstructural~~ cracks, and is designed to resist the passage of water under hydrostatic pressure or through capillary action, which may penetrate the building assembly.

Commenter's Reason: Reference to the type of crack is unnecessary in the definition as there are many kinds of cracks. Whether structural or

non-structural is immaterial; repairs to structural cracks are required to be completed prior to application of waterproofing. The committee cited R406.2 as providing definition of waterproofing, however, that section identifies where waterproofing is required and lists examples of waterproofing products.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change proposal will not increase the cost of construction as it is simply correcting the definition for clarity reasons.

Public Comment# 1526

RB30-19

IRC@: SECTION R202, 202, R301.1.4 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R202 DEFINITIONS

Add new text as follows:

INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

R301.1.4 Intermodal shipping containers. Intermodal shipping containers shall be designed in accordance with the structural provisions in Section 3114 of the International Building Code.

Reason: This code change purpose is to introduce intermodal shipping containers into the International Residential Code based on requests by code officials in the U.S. Prior to this proposal, several jurisdictions had created their own individual regulations or ordinances, or had administered additional requirements beyond the code (e.g. Section R104.11 "Alternative Materials, design and methods of construction and equipment") so as to be comfortable to ensure a safe structure. This code change proposal is in response to those requests to develop a provision in order to establish a consistent set of provisions which cover the minimum safety requirements, but which do not duplicate existing code provisions.

The proposed definition is consistent with the successful code change proposal to the International Building Code, new Section 3114. For consistency, we are introducing that same definition here.

The reference to the International Building Code has been modeled after Sections R301.1.1 through R301.1.3. The BCAC Shipping Container Working Group chose not to duplicate the newly accepted shipping container structural design language in the International Building Code. This proposal is making a simple reference the new section in the IBC where the provisions for shipping container structural safety are contained. As Section R301.1 applies to structural design only, the other non-structural provisions of the International Residential Code would apply as required (e.g. energy, plumbing, mechanical, electrical, etc.). Also, because Section R301.1.1 deals with primarily alternative sources of structural design (e.g. independent reference standard structural design resources outside the codes), the BCAC shipping container Working Group determined it to be more appropriate to separate this reference to the IBC for clarity.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The code change proposal will decrease the cost of construction. This new code section will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for residential building construction. Current use of repurposed intermodal shipping containers requires the owner or builder to submit through the alternative means and methods administrative provisions.

RB30-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This should simply reference the IBC for intermodal shipping containers. These structures need to be engineered and don't belong in the IRC. (Vote: 8-3)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IRC@: R301.1.4 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R301.1.4 Intermodal shipping containers. Intermodal shipping containers that are repurposed for use as buildings or structures, or as part of buildings or structures, shall be designed in accordance with the structural provisions in Section 3114 of the International Building Code.

Commenter's Reason: The IRC-B code development committee noted that the original proposal as written should be disapproved because:

- Shipping containers belong in the International Building Code.
- Performance based design required therefore does not belong in IRC.
- User can apply through the alternate means and methods provisions.
- The proposed language literally says nothing about utilizing shipping containers for structures and buildings.

We believe the arguments for an only IBC provision fall short as a result of comments brought to the shipping container task group's attention. One most notable finding was that there is still the belief that since the IRC does not address intermodal shipping containers that they are exempt from the IRC. Other comments received by the task group were views that since the containers are already designed and constructed to ISO specifications that there is no further need to design for use as dwellings. Both types of assumptions are not accurate. Therefore, it suggests a need for a direct reference.

Further, the shipping container task group has received compliments for proposing this language as it makes clear that said repurposed containers are in fact subject to the IBC structurally and the IRC for the remainder of the required code required attributes.

In regard to the perception that the proposed language falls short of identifying the utilization of shipping containers, we agree. In response we have modified the provision to address this short fall.

In view of the above, we recommend that this proposal be given consideration "as modified" at the fall ICC code hearings.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change proposal and public comment will decrease the cost of construction. This new section will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for residential building construction. Current use of repurposed intermodal shipping containers requires the owner or builder to submit through the alternative means and methods administrative process.

RB33-19

IRC@: TABLE R301.2(1)

Proposed Change as Submitted

Proponents: Gil Rossmiller, representing Colorado Chapter ICC (gilrossmiller@coloradocode.net)

2018 International Residential Code

**TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA**

GROUND SNOW	WIND DESIGN				SEISMIC DESIGN CATEGORY ¹	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP ²	ICE BARRIER UNDERLAYMENT REQUIRED ³	FLOOD HAZARDS ⁴	AIR FREEZING INDEX ⁵	MEAN ANNUAL TEMP ⁶
	LOAD ⁷	Speed ^d (mph)	Topographic effects ^a	Special wind region ¹		Wind-borne debris zone ^m	Weathering ²	Frost line depth ^b					
—	—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA⁸													
Elevation			Latitude	Winter heating	Summer cooling	Altitude correction factor ²		Indoor design temperature	Design temperature cooling		Heating temperature difference		
—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cooling temperature difference			Wind velocity heating	Wind velocity cooling	Coincident wet bulb	Daily range		Winter humidity	Summer humidity		—		
—	—	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

- a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, "negligible," "moderate" or "severe" for concrete as determined from Figure R301.2(4). The grade of masonry un
- b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.
- c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.
- d. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(5)A]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.

- e. ~~The outdoor design dry-bulb temperature shall be selected from the columns of 97¹/₂-percent values for winter from Appendix D of the International Plumbing Code. Deviations from the Appendix D temperatures shall be permitted to reflect local climates or local weather experience as determined by the building official. [Also see Figure R301.2(1)]~~
- f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.
- g. The jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the Flood Insurance Study and (c) the panel numbers and dates of the currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having jurisdiction, as amended.
- h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1 and R905.8.3.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall fill in this part of the table with "NO."
- i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."
- j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."
- k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall indicate "NO" in this part of the table.
- l. In accordance with Figure R301.2(5)A, where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.
- m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.
- n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.
- o. The jurisdiction shall fill in this section of the table using the Ground Snow Loads in Figure R301.2(6).
- p. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria as determined by the jurisdiction.

Reason: The overall change will help jurisdictions complete the manual J portion of the table and help plans examiners in completing reviews. The upper portion of the table remains unchanged, except for the removal of the "WINTER DESIGN TEMP^o" column and footnote e. This currently creates a conflict within the table itself. Footnote e states the winter design temperature shall be selected from appendix D of the International Plumbing Code using the 97 ½ percent value. The Manual J portion states that the winter design come from table 1A which uses the 99 percent value. Removing the "WINTER DESIGN TEMP^o" column and footnote e eliminates this conflict.

The Manual J portion has been reformatted to clarify the design parameters and removed default values. We will take each cell and explain:

Wind Velocity Heating: Deleted from table

This value is not found in table 1A or 1B of Manual J. The default value in Manual J is 7.5mph. This is also the default value used in all Manual J software. For those who have a Manual J (version two) the explanation is on page 177 and is reprinted here for all to review:

"The default values for wind velocity are 15 MPH for heating and 7 ½ MPH for cooling. These velocities do not represent the most severe wind conditions that will be experienced when the outdoor temperature is at the winter or summer design temperature, but they do represent values that are compatible with normal weather patterns. If a location has a reputation for wind velocities that consistently exceed these defaults during non-storm conditions, an appropriate set of velocity values may be substituted for the default values."

Wind Velocity Cooling: Deleted from table See reason above

Elevation: Unchanged

Altitude Correction Factor °: Added new footnote

Provides direction to the correct table in Manual J. This is the only value in the Manual J section that does not appear in table 1A or 1B

o. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.

Summer design grains: New

This was added to help the plans examiner during plan review. This is a critical design perimeter as this the one of the values used to calculate the latent load (moisture) for cooling. This is the value that designers will change to increase (artificially) the latent load for cooling and therefore the need for larger equipment. This value is plainly seen in Manual J reports. We have provided two examples below and a portion of Manual J table 1A.

Indoor winter design relative humidity: Modified

Was labeled 'Winter humidity' and was assumed that this was indoor design relative humidity. This change makes it clear.

Indoor winter design temperature: Modified

Was labeled 'Indoor design temperature' and was assumed to be the winter design as it was under the "WINTER DESIGN TEMP^o" column. With the above coulomb removed this change makes it clear the value should be the indoor winter design temperature.

Outdoor winter design temperature: Modified

Was labeled 'Winter heating' and was assumed that this was outdoor design temperature. This change makes it clear.

Heating temperature difference: Unchanged.

Latitude: Unchanged

Daily range: Unchanged

Coincident wet bulb: Unchanged

Indoor summer design relative humidity: Modified

Was labeled 'Summer humidity' and was assumed that this was the indoor design relative humidity. This change makes it clear.

Indoor summer design temperature: Modified

This was labeled as 'Design temperature cooling' and was assumed to be the indoor summer design temperature. This change makes it clear.

Cooling temperature difference: Unchanged

FOOTNOTES: The language of the footnotes remains unchanged. They were renumbered do to the removal of footnote e and a new footnote o.

Examples of a completed Manual J Table:

FOR DENVER, COLORADO

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD ^a	WIND DESIGN				SEISMIC DESIGN CATEGORY ^b	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED ^c	FLOOD HAZARDS ^d	AIR FREEZING INDEX ^e	MEAN ANNUAL TEMP ^f
	Speed ^g (mph)	Topographic Effects ^h	Special wind Region ⁱ	Windborne debris zone ^j		Weathering ^k	Frost line depth ^l	Termite ^m				
—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIAⁿ												
Elevation	Altitude correction factor^o		Summer design grains	Indoor winter design relative humidity	Indoor winter design temperature	Outdoor winter design temperature	Heating temperature difference					
5283	0.84		-33 to -48	30%	70°	-3°	73°					
Latitude	Daily range		Coincident wet bulb	Indoor summer design relative humidity	Indoor summer design temperature	Outdoor summer design temperature	Cooling temperature difference					
39	H		59°	50%	75°	90°	15°					

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD*	WIND DESIGN				SEISMIC DESIGN CATEGORY*	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED?	FLOOD HAZARDS?	AIR FREEZING INDEX*	MEAN ANNUAL TEMP*
	Speed ² (mph)	Topographic Effects ²	Special wind Region*	Windborne debris zone ²		Weathering*	Frost line depth*	Termite*				
—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA*												
Elevation	Altitude correction factor.*	Summer design grains	Indoor winter design relative humidity	Indoor winter design temperature	Outdoor winter design temperature	Heating temperature difference						
10	1.00	59 to 72	30%	70°	35°	35°						
Latitude	Daily range	Coincident wet bulb	Indoor summer design relative humidity	Indoor summer design temperature	Outdoor summer design temperature	Cooling temperature difference						
29	M	78°	50%	75°	89°	15°						

PORTION OF TABLE 1A FROM ACCA MANUAL J

Table 1A
Outdoor Design Conditions for the United States

Location	Elevation	Latitude	Winter		Summer				
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
St. Augustine	10	29	35	89	78	59	66	72	M
St. Petersburg	11	28	47	93	79	59	66	72	M

As you can see from the tables above there is a large difference in the design grains from a dry climate like Denver, Colorado and humid climate like St. Augustine, Florida. You can also see from table 1A that depending on your indoor relative humidity design the design grains change. The key for reviewers is not to get stuck on an exact number, but to know that dry climates will always have a negative number and humid climates will have a positive number.

PARTIAL MANUAL J REPORT FROM WRIGHTSOFT SOFTWARE

Design Conditions					
Location: Denver, CO, US Elevation: 5331 ft Latitude: 40°N			Indoor: Indoor temperature (°F) Design TD (°F) Relative humidity (%) Moisture difference (gr/lb)	Heating 70 73 30 35.3	Cooling 75 15 50 -35.9
Outdoor: Dry bulb (°F) Daily range (°F) Wet bulb (°F) Wind speed (mph)	Heating -3 - - 15.0	Cooling 90 27 (H) 59 7.5	Infiltration: Method Construction quality Fireplaces	Simplified Average 0	

PARTIAL MANUAL J REPORT FROM ELITE SOFTWARE

Design Data

Reference City: Denver, Colorado
Building Orientation: Front door faces Southeast
Daily Temperature Range: High
Latitude: 39 Degrees
Elevation: 5830 ft.
Altitude Factor: 0.807
Elevation Sensible Adj. Factor: 1.000
Elevation Total Adj. Factor: 1.000
Elevation Heating Adj. Factor: 1.000
Elevation Heating Adj. Factor: 1.000

	<u>Outdoor Dry Bulb</u>	<u>Outdoor Wet Bulb</u>	<u>Outdoor Rel.Hum</u>	<u>Indoor Rel.Hum</u>	<u>Indoor Dry Bulb</u>	<u>Grains Difference</u>
Winter:	-3	-3.7	80%	30%	70	35.77
Summer:	90	59	17%	50%	75	-37

The two reports above are both for Denver, Colorado and both are correct and yet you see the Grains Difference are not the same. This value will vary slightly depending on the weather data within the software. Again, small differences will not change the calculation significantly.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The revised table will not increase the heating or cooling loads. It may help for more accurate load calculations, therefore smaller equipment and possible reduced costs.

RB33-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The winter design temperature should not be removed. The reason statement does not correspond with the graphic. The proposal needs to protect solar systems from freezing as required under M2301.2.6 and protect pipes from freezing in Sections P2603.5 and P3001.2. (Vote: 11-0)

Assembly Action:

None

RB33-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R301.2(1)

Proponents:

Gil Rossmiller, representing Colorado Chapter, ICC (gilrossmiller@coloradocode.net)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

GROUND SNOW LOAD ^o	WIND DESIGN				SEISMIC DESIGN CATEGORY ^f	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP ^e	ICE BARRIER UNDERLAYMENT REQUIRED ^h	FLOOD HAZARDS ^g	AIR FREEZING INDEX ⁱ	MEAN ANNUAL TEMP ^j
	Speed ^d (mph)	Topographic effects ^k	Special wind region ^l	Wind-borne debris zone ^m		Weathering ^a	Frost line depth ^b	Termite ^c					
—	—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIAⁿ													
Elevation	Latitude		Winter heating	Summer cooling	Altitude correction factor		Indoor design temperature	Design temperature cooling		Heating temperature difference			
	Altitude correction factor ^o		Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature			Outdoor winter design dry-bulb temperature					
—	—		—	—	—		—	—		—			
Cooling temperature difference	Wind velocity heating	Wind velocity cooling	Coincident wet bulb	Daily range		Winter humidity	Summer humidity		Cooling temperature difference				
Latitude	Daily range	Summer design grains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature			Outdoor summer design dry-bulb temperature						
—	—	—	—	—		—	—		—				

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

- a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, "negligible," "moderate" or "severe" for concrete as determined from Figure R301.2(4). The grade of masonry units shall be determined from ASTM C34, C55, C62, C73, C90, C129, C145, C216 or C652.
- b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.
- c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.
- d. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(5)A]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.
- e. ~~The outdoor design dry-bulb temperature shall be selected from the columns of 97 1/2 percent values for winter from Appendix D of the International Plumbing Code. Deviations from the Appendix D temperatures shall be permitted to reflect local climates or local weather experience as determined by the building official. [Also see Figure R301.2(1).] The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.~~
- f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.
- g. The jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the Flood Insurance Study and (c) the panel numbers and dates of the currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having jurisdiction, as amended.
- h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1 and R905.8.3.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall fill in this part of the table with "NO."
- i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."
- j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."
- k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

- l. In accordance with Figure R301.2(5)A, where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.
- m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.
- n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.
- o. The jurisdiction shall fill in this section of the table using the Ground Snow Loads in Figure R301.2(6).

Commenter's Reason:

Committee Action was for disapproval

Published committee reason:

Committee Reason: The winter design temperature should not be removed. The reason statement does not correspond with the graphic. The proposal needs to protect solar systems from freezing as required under M2301.2.6 and protect pipes from freezing in Sections P2603.5 and P3001.2. (Vote: 11-0)

The major reason the committee was confused was that the proposal that I approved was not published in the monograph correctly. This was my fault in not reviewing what was published in the monograph, which was completely wrong. The proposal as revised (and originally) only referenced Manual J for the winter design temperature rather than the current conflict with the plumbing code. See my reason statement.

The overall change will help jurisdictions complete the manual J portion of the table and help plans examiners in completing reviews.

Currently the table has two different outdoor winter design dry-bulb temperatures. Creating a conflict within the table itself.

The upper portion of the table remains unchanged, except for the removal of the "WINTER DESIGN TEMP^o" column and footnote e. Footnote e states the winter design temperature shall be selected from appendix D of the International Plumbing Code using the 97 ½ percent value.

The Manual J portion states that the winter design comes from table 1A which uses the 99 percent value. Removing the "WINTER DESIGN TEMPe" column and footnote e eliminates this conflict. The Manual J portion of the table has been reformatted to clarify the design parameters and removes default values. We will take each cell and explain:

Wind Velocity Heating: Deleted from table

This value is not found in table 1A or 1B of Manual J. The default value in Manual J is 15 mph. This is also the default value used in all Manual J software. For those who have a Manual J (version two) the explanation is on page 177 and is reprinted here for all to review

"The default values for wind velocity are 15 MPH for heating and 7 ½ MPH for cooling. These velocities do not represent the most severe wind conditions that will be experienced when the outdoor temperature is at the winter or summer design temperature, but they do represent values that are compatible with normal weather patterns. If a location has a reputation for wind velocities that consistently exceed these defaults during non-storm conditions, an appropriate set of velocity values may be substituted for the default values."

Wind Velocity Cooling: Deleted from table. See reason above

Elevation: Unchanged

Altitude Correction Factor^e : Added and revised footnote ^e

Provides direction to the correct table in Manual J. This value does not appear in table 1A or 1B of Manual J.

e. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.

Summer design grains: New

This was added to help the plans examiner during plan review. This is a critical design parameter as this is one of the values used to calculate the latent load (moisture) for cooling. Designers will change this value to increase (artificially) the latent load for cooling and therefore the need for larger equipment. This value is plainly seen in Manual J reports. We have provided two examples below and a portion of Manual J table 1A.

Indoor winter design relative humidity: Modified

This cell was originally labeled 'Winter humidity' and was assumed that this was indoor design relative humidity. This change makes it clear that the

value is the indoor winter design relative humidity.

Indoor winter design dry-bulb temperature: Modified

This cell was originally labeled 'Indoor design temperature' and was assumed to be the indoor winter design dry-bulb temperature as it was under the "WINTER DESIGN TEMPe" column. With the "WINTER DESIGN TEMPe" column removed this change makes it clear the value is the indoor winter design dry-bulb temperature.

Outdoor winter design dry-bulb temperature: Modified

This cell was originally labeled 'Winter heating' and was assumed that this was outdoor design dry-bulb temperature. This change makes it clear the value is the outdoor winter design dry-bulb temperature .

Heating temperature difference: Unchanged. Just relocated in the table

Latitude: Unchanged. Just relocated in the table

Daily range: Unchanged. Just relocated in the table

Coincident wet bulb: Unchanged. Just relocated in the table

Indoor summer design relative humidity: Modified

This cell was originally labeled 'Summer humidity' and was assumed that this was the indoor design relative humidity. This change makes it clear the value is the indoor summer design relative humidity.

Indoor summer design dry-bulb temperature: Modified

This cell was originally labeled as 'Design temperature cooling' and was assumed to be the indoor summer design dry-bulb temperature. This change makes it clear the value is the indoor summer design dry-bulb temperature.

Outdoor summer design dry-bulb temperature: Modified

This cell was originally labeled 'Summer Cooling' and was assumed to be the outside dry-bulb design temperature. This change makes it clear the value is the outdoor summer design dry-bulb temperature.

Cooling temperature difference: Unchanged. Just relocated

Footnotes: Except for footnote⁹ all other footnotes remain unchanged.

Examples of a completed Manual J table as proposed by the public comment and screen shots from Manual J table 1A:

For St. AUGUSTINE, FLORIDA

**Table 1A
Outdoor Design Conditions for the United States**

Location	Elevation	Latitude	Winter		Summer				Daily Range (DR)
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	
St. Augustine	10	29	35	89	78	59	66	72	M
St. Petersburg	11	28	47	93	79	59	66	72	M

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD ^a	WIND DESIGN				SEISMIC DESIGN CATEGORY ^a	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED ^a	FLOOD HAZARDS ^f	AIR FREEZING INDEX ^b	MEAN ANNUAL TEMP ^l
	Speed ^d (mph)	Topographic Effects ⁱ	Special wind Region ^k	Windborne debris zone ^l		Weathering ^a	Frost line depth ^a	Termite ^a				
—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA ^m												
Elevation	Altitude correction factor ^a		Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature		Outdoor winter design dry-bulb temperature	Heating temperature difference				
10	1.00		78°	30%	70°		35°	35°				
Latitude	Daily range		Summer design grains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature		Outdoor summer design dry-bulb temperature	Cooling temperature difference				
29	M		59 to 72	50%	75°		89°	16°				

For DENVER, COLORADO

Table 1A
Outdoor Design Conditions for the United States

Location	Elevation Feet	Latitude Degrees North	Winter		Summer					
			Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)	
Colorado										
Alamosa AP	7543	37	-11	82	55	-53	-46	-40	H	
Boulder	5385	40	0	91	59	-47	-40	-34	H	
Colorado Springs AP	6171	38	4	87	58	-46	-39	-33	H	
Craig	6283	40	-12	85	56	-52	-45	-39	H	
Denver AP	5283	39	-3	90	59	-46	-39	-33	H	

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD ^a	WIND DESIGN				SEISMIC DESIGN CATEGORY ^a	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED ^a	FLOOD HAZARDS ^f	AIR FREEZING INDEX ^b	MEAN ANNUAL TEMP ^l
	Speed ^d (mph)	Topographic Effects ⁱ	Special wind Region ^k	Windborne debris zone ^l		Weathering ^a	Frost line depth ^a	Termite ^a				
—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA ^m												
Elevation	Altitude correction factor ^a		Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature		Outdoor winter design dry-bulb temperature	Heating temperature difference				
5283	0.84		59°	30%	70°		-3°	73°				
Latitude	Daily range		Summer design grains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature		Outdoor summer design dry-bulb temperature	Cooling temperature difference				
39	H		-33 to -48	50%	75°		90°	15°				

As you can see from the tables above there is a large difference in the design grains from a dry climate like Denver, Colorado and humid climate like St. Augustine, Florida. You can also see from table 1A that depending on your indoor relative humidity design the design grains change. The key for reviewers is not to get stuck on an exact number, but to know that dry climates will always have a negative number and humid climates will have a positive number.

PARTIAL MANUAL J REPORT FROM WRIGHTSOFT SOFTWARE

Design Conditions					
Location:			Indoor:	Heating	Cooling
Denver, CO, US			Indoor temperature (°F)	70	75
Elevation: 5331 ft			Design TD (°F)	73	15
Latitude: 40°N			Relative humidity (%)	30	50
Outdoor:	Heating	Cooling	Moisture difference (gr/lb)	35.3	-35.9
Drybulb (°F)	-3	90	Infiltration:		
Daily range (°F)	-	27 (H)	Method	Simplified	
Wet bulb (°F)	-	59	Construction quality	Average	
Wind speed (mph)	15.0	7.5	Fireplaces	0	

PARTIAL MANUAL J REPORT FROM ELITE SOFTWARE

Design Data	
Reference City:	Denver, Colorado
Building Orientation:	Front door faces Southeast
Daily Temperature Range:	High
Latitude:	39 Degrees
Elevation:	5830 ft.
Altitude Factor:	0.807
Elevation Sensible Adj. Factor:	1.000
Elevation Total Adj. Factor:	1.000
Elevation Heating Adj. Factor:	1.000
Elevation Heating Adj. Factor:	1.000

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-3	-3.7	80%	30%	70	35.77
Summer:	90	59	17%	50%	75	-37

The two reports above are both for Denver, Colorado and both are correct and yet you see the Grains Difference are not the same. This value will vary slightly depending on the weather data within the software. Again, small differences will not change the calculation significantly.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The revised table will not increase the heating or cooling loads. It may help for more accurate load calculations, therefore smaller equipment and possible reduced costs.

RB40-19

IRC@: 202 (New), R301.2.2.6

Proposed Change as Submitted

Proponents: Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (KCobeen@wje.com); Julie Furr, Rimkus Consulting Group, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (jfurr@rimkus.com); Michael Mahoney, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

2018 International Residential Code

Add new definition as follows:

CRIPPLE WALL CLEAR HEIGHT. The vertical height of a *cripple wall* from the top of the foundation to the underside of floor framing above.

Revise as follows:

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in Seismic Design Categories C, D₀, D₁ and D₂ and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 7.8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

1. **Shear wall or braced wall offsets out of plane.** Conditions where exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that all of the following are satisfied:

1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
 2. The ratio of the back span to the cantilever is not less than 2 to 1.
 3. Floor joists at ends of *braced wall panels* are doubled.
 4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and 1 1/2 inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
 5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.
2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.

Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.

3. Shear wall or braced wall offsets in plane. Conditions where the end of a braced wall panel occurs over an opening in the wall below and extends more than 1 foot (305 mm) horizontally past the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane in accordance with the exception to Item 1.

Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
2. The header is composed of:
 - 2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.
 - 2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
 - 2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
3. The entire length of the *braced wall panel* does not occur over an opening in the wall below.

4. Floor and roof opening. Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.
5. Floor level offset. Conditions where portions of a floor level are vertically offset.

Exceptions:

1. Framing supported directly by continuous foundations at the perimeter of the building.
 2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.
6. Perpendicular shear wall and wall bracing. Conditions where shear walls and *braced wall lines* do not occur in two perpendicular directions.
 7. Wall bracing in stories containing masonry or concrete construction. Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

Exception: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. Hillside Light-Frame Construction. Light-frame construction in which both Items 1 and 2 below apply:

8.1 The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and

8.2 The tallest cripple wall clear height exceeds 7'-0", or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".

Exception : Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Reason: As part of work contributing to FEMA P-1100 (Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings Volume 1 - Prestandard), it was identified that for light-frame dwellings on steep hillsides (Figure 1), adequate seismic performance does not occur when seismic design is based on typical seismic force distribution assumptions (tributary area, flexible diaphragm). Whether loading is in the cross-slope or out-of-hill direction (Figure 2), seismic forces follow the stiffest load path to the uphill foundation, rather than distributing uniformly to all the bracing walls in the way assumed in development of IRC seismic bracing provisions. For this reason, design using the IRC bracing provisions will not provide adequate seismic performance. This change proposal triggers an engineered lateral force design for hillside dwellings by adding the hillside dwelling configuration to the already existing list of configurations deemed to be irregular for seismic design purposes.

This dwelling configuration was illustrated to be vulnerable in the 1994 Northridge, California Earthquake. The Earthquake Spectra Northridge Earthquake Reconnaissance Report (Volume 2, EERI, 1996) reported 117 significantly damaged hillside dwellings of the bearing wall type and 40 of the post and beam (stilt) type. Fifteen dwellings were reported to have collapsed or were so near collapse that they were immediately demolished and another fifteen came close to collapsing. HUD (1994) also reported significant damage to hillside dwellings. As examples of vulnerable hillside dwelling performance, Figure 3 illustrates a dwelling that pulled about six inches away from the uphill foundation, but did not collapse, and Figure 4 illustrates one of the collapsed dwellings.

Blaney et. Al (2018), illustrates results from numerical studies used in development of FEMA P-1100. Figure 18 of this reference indicates that for a studied hillside dwelling, the probability of collapse in the risk-adjusted maximum considered earthquake (MCE_R) was reduced by more than a factor of seven by changing from typical prescriptive bracing practice to an engineered methodology that considered the seismic response. More background on dwelling past performance and the numerical studies are found in FEMA P-1100.

The Item 1 grade slope trigger is used to limit applicability of this irregularity to dwellings that are on sites with a significant slope (Figure 5). Averaging the grade slope along the side of the dwelling is intended to focus on the overall drop in grade elevation across the dwelling and not trigger the irregularity based only on limited areas of higher grade slope. This is consistent with the numerical studies that form the basis of this proposal. For most dwellings this criterion will be evaluated by looking at each of the four primary elevations. For large and more complex dwellings, additional “sides” will need to be evaluated.

Item 2 adds a second trigger of downhill cripple wall height greater than 7'-0" (Figure 6) or downhill post clear height in post and pier dwelling (Figure 7) based on the FEMA P-1100 numerical studies. Both Items 1 and 2 need to be triggered in order to qualify for dwelling to be qualified as irregular. These triggers were observed to be the points at which damage and displacements at the uphill foundation were thought to significantly increase the likelihood of collapse.

The exception scopes out of irregularity Item 8 dwellings that have full-height concrete or masonry walls (Figure 8) because this configuration was not part of the numerical studies that form the basis of this proposal. For a dwelling with a simple rectangular floor plan, full height concrete or masonry walls would need to occur on three sides to qualify for the exception. For a more complex dwelling plan configuration, additional concrete or masonry walls would be required to qualify for the exception. Dwellings with doors and windows in the concrete or masonry walls still qualify for the exception. In all dwellings the concrete or masonry walls will need to conform to applicable IRC provisions.

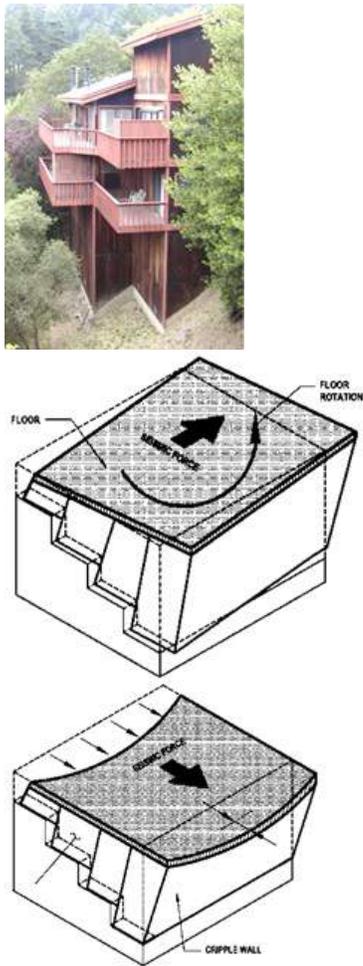


Figure 1 Hillside light-frame structure. Figure 2. Hillside structure cross-slope and out-of-hill loading.



Figure 3. Hillside dwelling pulled away from uphill foundation in the 1994 Northridge, California Earthquake (Credit: City of Los Angeles Department of Building and Safety). Red arrow shows location where floor framing has pulled six to eight inches away from the uphill foundation.



Figure 4. Hillside dwelling collapsed in the 1994 Northridge, California Earthquake (Credit: City of Los Angeles Department of Building and Safety).

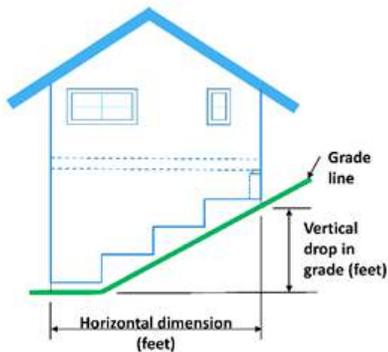


Figure 5. Grade slope triggering the hillside dwelling irregularity exceeds 1 vertical in 5 horizontal across the full width of any side of the dwelling.

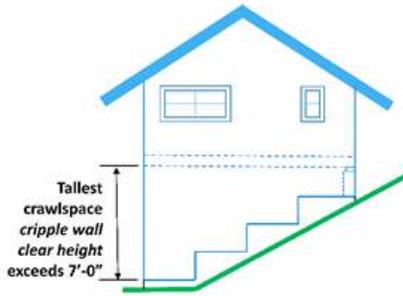


Figure 6. Downhill cripple wall height triggering the hillside dwelling irregularity.

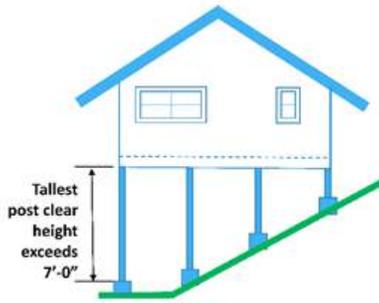


Figure 7. Downhill post height triggering the hillside dwelling irregularity.

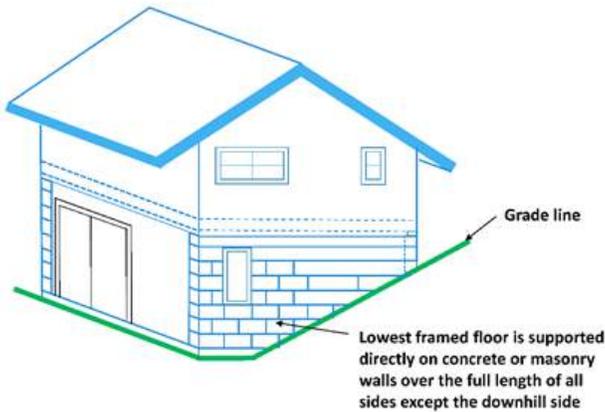


Figure 8. Concrete or masonry wall configuration that does not trigger the hillside dwelling irregularity.

Bibliography: FEMA, 2018. *Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings Volume 1 - Prestandard (FEMA P-1100)*, Federal Emergency Management Agency, Washington, DC.

Blaney et. Al., 2018. "Prestandard for Seismic Assessment and Retrofit of One- and Two-Family Dwellings (FEMA P-1100, ATC-110 Project)," *Proceedings of the 2018 SEAOC Convention*, SEAOC, Sacramento, CA.

EERI, 1996. 1994 Northridge California Earthquake. *The Earthquake Spectra Northridge Earthquake Reconnaissance Report*, EERI, Oakland, CA.

HUD, 1994. *Performance of HUD-Assisted Properties During the January 17, 1994 Northridge Earthquake*, U.S. Department of Housing and Urban Development, Washington, D.C.

Cost Impact: The code change proposal will increase the cost of construction

This proposal is anticipated to increase the number of dwellings required to have an engineered lateral force design for moderately steep to very steep sites. In regions where these dwellings are believed to already be predominantly engineered, the cost impact is thought to be negligible. In other regions where these dwellings are not predominantly engineered, additional costs will be incurred for engineered design and more robust anchorage to the foundation.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R301.2.2.6.....

8. Hillside Light-Frame Construction. Conditions in which all of the following apply: ~~Light frame construction in which both Items 1 and 2 below apply:~~

8.1. The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and

8.2. The tallest *cripple wall clear height* exceeds 7'-0", or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".

8.3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50% is *living space* having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor diaphragm immediately above the cripple walls or post and beam system and all structural elements and connections from this diaphragm down to and including the foundation.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Committee Reason: Structures on sloped lots do not currently have adequate design parameters. The modification corrects the indents for Item 8 and revises the first sentence of Item 8 to address the addition of Item 8.3. (Vote: 11-0)

Assembly Action:

None

RB40-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R301.2.2.6

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in Seismic Design Categories C, D₀, D₁ and D₂ and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

1. **Shear wall or braced wall offsets out of plane.** Conditions where exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that all of the following are satisfied:

 1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
 2. The ratio of the back span to the cantilever is not less than 2 to 1.
 3. Floor joists at ends of *braced wall panels* are doubled.
 4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and 1¹/₂ inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
 5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.

Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.

3. Shear wall or braced wall offsets in plane. Conditions where the end of a braced wall panel occurs over an opening in the wall below and extends more than 1 foot (305 mm) horizontally past the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane in accordance with the exception to Item 1.

Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

 1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
 2. The header is composed of:
 - 2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.
 - 2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
 - 2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
 3. The entire length of the *braced wall panel* does not occur over an opening in the wall below.

4. Floor and roof opening. Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.

5. Floor level offset. Conditions where portions of a floor level are vertically offset.

Exceptions:

 1. Framing supported directly by continuous foundations at the perimeter of the building.
 2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.

6. Perpendicular shear wall and wall bracing. Conditions where shear walls and *braced wall lines* do not occur in two perpendicular directions.

7. Wall bracing in stories containing masonry or concrete construction. Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

Exception: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. Hillside Light-Frame Construction. Conditions in which all of the following apply:
- 8.1. The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and
 - 8.2. The tallest *cripple wall clear height* exceeds 7'-0", or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".
 - 8.3. Of the total plan area below the lowest framed door, whether open or enclosed, less than 50% is *living space* having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor diaphragm immediately above the cripple walls or post and beam system and all structural elements and connections from this diaphragm down to and including connections to the foundation and design of the foundation to transfer lateral loads from the framing above.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Commenter's Reason: The purpose of this public comment is to focus the engineered analysis of foundations triggered by the presence of the hillside home irregularity on the anchorage of light-frame crawlspace or basement walls and light-frame floor diaphragms above to a concrete or masonry foundation wall and the transfer of lateral forces through that anchorage to the foundation and to the soil. As written, the description of the elements to be designed could be taken to include engineered design of concrete and masonry foundations walls for out-of-plane soil forces in addition to the lateral forces from the light-frame structure above. This may lead to such foundation walls needing to be designed for higher soil pressures per IBC Table 1610.1. In addition, out-of-plane seismic soil pressures may need to be applied. The results can be increased wall thickness, greater amounts of reinforcing, and larger footings (with accompanying reinforcing), significantly driving up the cost of construction.

The FEMA P-1100 prestandard on which RB40 is based focuses on concerns with light-frame wall anchorage to foundations and the transfer of those lateral loads. It discusses the need for insuring foundation elements to have the proper width and depth to accommodate retrofit anchors and have the minimum necessary concrete strength and quality to support the loads from the retrofit anchors. P-1100 does not raise concerns about other facets of foundation wall construction and design, especially not resistance to out-of-plane soil loads.

This clarification is consistent with the general intent of Section R301.2.2.6 that the level of engineered design undertaken to address an irregularity is only needed to the extent the irregularity affects the performance of the structural system. Clearly, the issue addressed by this new irregularity is the capacity of the dwelling's seismic force-resisting system, not the effects of soil pressure on the foundation walls.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As noted by the proponents, where the new irregularity applies the cost of construction may increase due to engineering fees and additional shear wall, floor diaphragm, floor anchorage and foundation wall costs. The public comment, if approved, would mitigate some of the cost increase by avoiding unnecessary design for out-of-plane soil loads beyond that required by the basic IRC provisions, and thus additional concrete or masonry wall and footing thickness and reinforcing not otherwise needed to address the hillside home irregularity itself.

Public Comment# 1363

Public Comment 2:

IRC®: R301.2.2.6

Proponents:

Shane Nilles, representing Self (snilles@cityofcheney.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in Seismic Design Categories C, D₀, D₁ and D₂ and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering

practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

1. **Shear wall or braced wall offsets out of plane.** Conditions where exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that all of the following are satisfied:

 1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
 2. The ratio of the back span to the cantilever is not less than 2 to 1.
 3. Floor joists at ends of *braced wall panels* are doubled.
 4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and 1½ inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
 5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.
2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.

Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.
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Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

 1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
 2. The header is composed of:
 - 2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.
 - 2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
 - 2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
 3. The entire length of the *braced wall panel* does not occur over an opening in the wall below.
4. Floor and roof opening. Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.
5. Floor level offset. Conditions where portions of a floor level are vertically offset.

Exceptions:

 1. Framing supported directly by continuous foundations at the perimeter of the building.
 2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.
6. Perpendicular shear wall and wall bracing. Conditions where shear walls and *braced wall lines* do not occur in two perpendicular directions.

7. Wall bracing in stories containing masonry or concrete construction. Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

Exception: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. Hillside Light-Frame Construction. Conditions in which all of the following apply:
- 8.1. The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and
 - 8.2. The tallest *cripple wall clear height* exceeds 7'-0" ~~or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0"~~.
 - 8.3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50% is *living space* having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor diaphragm immediately above the cripple walls ~~or post and beam system~~ and all structural elements and connections from this diaphragm down to and including the foundation.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Commenter's Reason: The original proposal modification does not take into account that all "floor system post or pier foundations" supporting braced wall panels are required to be designed in accordance with engineering practices per R602.10.9. If the proposal is accepted as it is currently written, it will conflict with provisions where it will imply that those hill-side buildings that have post and beam support systems where the posts do not exceed 7' in height are not required to be engineered whereas R602.10.9 does require it regardless of the height of the posts. This would result in buildings being built with less consideration for the structural concerns that the proposal is intending to address. This public comment corrects this conflict while maintaining the intent of the proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment modification does not increase or decrease the cost of construction beyond that of the original proposal.

Public Comment# 2142

Proposed Change as Submitted

Proponents: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org); Gary Ehrlich, National Association of Home Builders, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

Revise as follows:

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with *story heights* not exceeding the following:

1. For wood wall framing, the *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).

Exception: A story height not exceeding 13 feet 7 inches is permitted provided the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or Exception 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10.

2. For cold-formed steel wall framing, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).

3. For masonry walls, the *story height* shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).

Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.

4. For insulating concrete form walls, the maximum story height shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per *story* as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).

5. For structural insulated panel (SIP) walls, the story height shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per *story* as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls. Individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided that the story heights of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the International Building Code .

Reason: The purpose of this code change is to finally address a long-standing conflict and point of confusion in the IRC story height provisions and restore the original intent of the IRC.

In the 2003 through 2006 IRC, the default provisions of Section R301.3 specified wood-frame buildings could have a maximum bearing wall stud height of 10 feet supporting framing members not exceeding 16" in depth. An exception allowed a maximum bearing wall stud height of 12 feet provided an engineered design for the wall and studs was provided for everything other than the wall bracing for wind and seismic loads, which could be determined per Section R602.10 with adjustment factors to increase the bracing amounts for the higher walls.

For the 2009 IRC, a successful proposal from SBCA revised Section R301.3 to allow floor framing members (e.g. I-joists or trusses) deeper than 16" to be used if the bearing wall stud height was less than 10 feet. This was accomplished by specifying an overall story height limit of 11'-7", or the sum of a 10'-0" tall stud, 2x top and bottom plates, and 16" deep framing.

This technically overrode the exception allowing bearing wall studs up to 12 feet with wall bracing per the Section R602.10 adjustment factors and engineering design otherwise, not to mention conflicting with the 12 foot bearing wall height limit for masonry walls and additional 8 feet allowed for gable end walls. However, to our recollection this was not brought up in floor testimony, committee discussion, or in public comments, and the change passed.

For the 2015 IRC, the BCAC further revised this section by deleting the 11'-7" story height limit from the final paragraph of Section R301.3 and placing it in each of the individual items to which it applied. This addressed the conflict with masonry walls but still did not fix the conflict with Section R602.10. To make matters worse, former members of the ICC Ad-Hoc Wall Bracing Committee advanced a proposal to delete the entire exception for bearing wall studs up to 12 feet out of a concern code users would double-count the multipliers on the wall bracing, which are reflected in the respective tables of adjustment factors for wind and seismic bracing. Neither the BCAC nor the former AHC-WB members provided a fix for the conflict between the story height limits and the wall bracing provisions.

For the 2018 IRC, NAHB added the new Table R602.3(6) allowing bearing wall studs up to 12 feet in height for limited cases. We still did not directly address the conflict between the story height limits and the wall bracing provisions, let alone the conflict with the new table. In essence, NAHB (and others modifying Section R301.3) have relied on the statement in the last paragraph that individual walls or wall studs could exceed the limits of R301.3 as long as overall story heights were not exceeded.

This proposal generally restores the exception present in the 2000 through 2012 IRC stating "the wall stud clear height used to determine the

maximum permitted story height may be increased to 12 feet without requiring an engineered design for the building wind and seismic force resisting systems” provided R602.10 is complied with, including mandated increases for stud heights up to 12 feet. At the same time, language is added pointing to the two exceptions to 10 foot bearing wall heights under Section R602.3, including the exception leading to the new Table R602.3(6). This will provide a critical link to both exceptions that is currently missing in the 2018 IRC. The requirement to use engineering design for studs in these tall walls not otherwise complying with one of the two exceptions to Section R602.3 is maintained.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change will not increase cost for builders in jurisdictions making a jump from the 2006 IRC or earlier directly to the 2021 IRC. The code change will also not increase cost for builders using subsequent editions and interpreting the language allowing individual walls or wall studs to exceed the limits of Section R301.3 to permit certain walls (e.g. foyers, great rooms, garages) to exceed the 11'-7" story height limit provided the average story height remains within the limit. The code change may decrease the cost of construction for builders who have been forced to hire structural engineers to design the lateral force-resisting system for houses with 11 or 12 foot bearing walls that would have met the 2000 through 2006 IRC but were excluded from the structural provisions of the IRC due to a strict interpretation of the language in the 2009 IRC and subsequent editions.

RB43-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Wind load factors need to be addressed before this proposal is moved forward. The committee hopes that the parties involved can get together and propose a public comment to resolve this issue. (Vote: 8-3)

Assembly Action:

None

RB43-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R301.3

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with *story heights* not exceeding the following:

1. For wood wall framing, the *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).

Exception: A story height not exceeding 13 feet 7 inches is permitted provided that the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or Exception 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10. Studs shall be laterally supported at the top and bottom plate in accordance with Section R602.3.

2. For cold-formed steel wall framing, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).
3. For masonry walls, the *story height* shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).

Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.

- For insulating concrete form walls, the maximum story height shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per story as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).
- For structural insulated panel (SIP) walls, the story height shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per story as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls, Individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6, provided that the *story heights* of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the International Building Code.

Commenter's Reason: The primary reason RB43 was disapproved was due to concerns raised as to whether the calculations for the adjustments to Chapter 6 wall bracing amounts for bearing walls over 10 feet but not exceeding 12 feet included the depth of floor framing in the wall height or considered it separately and in addition to the bearing wall height.

NAHB was a member of the ICC Ad-Hoc Wall Bracing Committee and worked closely with the committee members who developed the wind bracing calculations. As such, NAHB has access to a copy of the spreadsheet used to generate the calculations. An extract from the portion of the spreadsheet where bracing amounts are calculated is included with this proposal. In the upper left hand corner of the extract, there is a yellow box for users of the spreadsheet to enter site data and building geometry. A close look at the items of building geometry can be entered reveals there is a box for entering floor framing depth separately from the wall stud height, and that the framing depth was set to one foot for calculating the Table R602.10.3(1) wind bracing amounts. It is noted the adjustment factors in Table R602.10.3(2) were calculated manually by separately running the wind bracing analysis for different building geometries (e.g. increasing the wall height) and comparing the results to determine the factors.

It is noted the story height limits in Section R301.3 are based on a 16" framing depth. However, the IRC is limited to three stories above grade plane, and therefore the difference between the Section R602.10 bracing assumptions and what Section R301.3 would permit is 8 inches. One would be hard pressed to argue an 8 inch difference will significantly compromise building performance in any way.

Members of the ATC/FEMA Seismic Code Support Committee expressed some concern over the need to make sure the top of the wall studs were properly braced by the floor and roof framing and diaphragms in the dwelling. Of particular concern were cases where the roof assembly had a cathedral or vaulted ceiling, so the framing and ceiling diaphragm were diagonal at the intersection with the wall. At the SCSC's request, NAHB agreed to add a sentence to the current provision in Section R602.3 that requires studs be continuous from a foundation or floor diaphragm below to a floor, roof or ceiling diaphragm above. That provision has been in the IRC since 2009 and would apply to the wall studs covered by RB43, but it certainly does no harm to re-emphasize the need for proper lateral support at the top of the studs.

As no other reasons were raised in opposition other than the confusion over the wind bracing assumptions, the committee action should be overturned and RB43 approved as submitted. This will allow us to finally fix the disconnect between Chapter 3 and Chapter 6 that has persisted for 4 code cycles and make this area of the IRC easier to interpret and enforce.

Required Length of Wall Bracing* for Wind Speed Using ASCE 7-1	Number of braced wall lines: 1.00	115 MPH				
		IRC Bracing Methods	115 MPH			
Stories Above Braced Wall Line	Roof Slope	Braced Wall Line Spacing	Factored ASD Required Shear Force at BWL	LM, GB	WSP/WVR, B, P, BS, P, S, HPS, CS, SFB	CS, WSR, CS, G, S, P, F
6-12 and Less	Adjusted Unit Shear Strength	10 ft	621 lbs.	240 pit.	420 pit.	420 pit.
		15 ft	891 lbs.	3.7 ft	1.5 ft	1.3 ft
		20 ft	1,163 lbs.	4.8 ft	2.1 ft	1.8 ft
		25 ft	1,410 lbs.	5.9 ft	2.7 ft	2.3 ft
		30 ft	1,665 lbs.	6.9 ft	3.4 ft	2.9 ft
		35 ft	1,917 lbs.	8.0 ft	4.0 ft	3.4 ft
		40 ft	2,169 lbs.	9.0 ft	4.6 ft	3.9 ft
		45 ft	2,420 lbs.	10.1 ft	5.2 ft	4.4 ft
		50 ft	2,671 lbs.	11.1 ft	5.8 ft	4.9 ft
		55 ft	2,921 lbs.	12.2 ft	7.0 ft	5.9 ft
		60 ft	3,172 lbs.	13.2 ft	7.6 ft	6.4 ft
		10 ft	830 lbs.	3.6 ft	2.0 ft	1.7 ft
15 ft	1,201 lbs.	5.0 ft	2.9 ft	2.4 ft		
20 ft	1,569 lbs.	6.5 ft	3.7 ft	3.1 ft		
25 ft	1,938 lbs.	7.9 ft	4.6 ft	3.8 ft		
30 ft	2,240 lbs.	9.3 ft	5.3 ft	4.5 ft		
35 ft	2,560 lbs.	10.7 ft	6.1 ft	5.2 ft		
40 ft	2,918 lbs.	12.2 ft	6.9 ft	5.9 ft		
45 ft	3,292 lbs.	13.6 ft	7.8 ft	6.6 ft		
50 ft	3,592 lbs.	15.0 ft	8.6 ft	7.3 ft		
55 ft	3,929 lbs.	16.4 ft	9.4 ft	8.0 ft		
60 ft	4,265 lbs.	17.8 ft	10.2 ft	8.6 ft		
* Adjusted Unit Shear Strength		240 pit.	420 pit.	420 pit.	2.9 ft	
10 ft		1,461 lbs.	6.0 ft	3.5 ft	2.9 ft	
15 ft		2,060 lbs.	8.7 ft	5.0 ft	4.2 ft	
20 ft		2,678 lbs.	11.2 ft	6.4 ft	5.4 ft	
25 ft		3,262 lbs.	13.6 ft	7.8 ft	6.6 ft	
30 ft		3,838 lbs.	15.0 ft	9.1 ft	7.8 ft	
35 ft		4,411 lbs.	16.4 ft	10.5 ft	8.9 ft	
40 ft		4,981 lbs.	20.8 ft	11.9 ft	10.1 ft	
45 ft		5,550 lbs.	23.1 ft	13.2 ft	11.2 ft	
50 ft		6,117 lbs.	25.5 ft	14.6 ft	12.4 ft	
55 ft		6,683 lbs.	27.9 ft	15.9 ft	13.5 ft	
60 ft		7,249 lbs.	30.2 ft	17.3 ft	14.7 ft	
10 ft		1,603 lbs.	6.7 ft	3.8 ft	3.2 ft	
15 ft		2,317 lbs.	9.7 ft	5.6 ft	4.7 ft	
20 ft		2,997 lbs.	12.5 ft	7.1 ft	6.1 ft	

3. Bracing amounts are based on load and resistance values from sheets 1 and 2. Yellow shading indicates a user input cell.

Site Data
 Basic Wind Speed: 115 mph (based on ASCE 7-10, Figure 26.5-1A for Risk Cat II Building)
 Exposure/Height Factor: 1 (from ASCE 7-10, Figure 26.6-1 based on Site Exposure and Me)
 Topographic Factor: 1 (from ASCE 7-10, Section 26.8)
 Importance Factor: 1 (use 1.0 for ASCE 7-10, Importance factor addressed by mapped ASD windload factor)
 ASD windload factor: 0.6 (from ASCE 7-10, Section 2.4)

Building Geometry
 Roof Ridge Height: 10 ft (vertical distance from eave to ridge)
 Wall Height: 10 ft (floor-to-ceiling)
 Floor Depth: 1 ft
 End Zone Parameter, z: 4 ft (from ASCE 7-10, Figure 26.6-1)

7/19/2019

INTERMITTENT & CONTINUOUS BRACING ANALYSIS PARAMETERS

Partial Restraint Factors	Partial Restraint and System Factor Values Based on --SEI--BRANZ Ventilation and CSIRO Verification Tests for specific verification
Roof Only	1. Liu, N.L. Rainier, Woonheung (2006), "Effect of upper story on the performance of wood shear walls", WCTE, Portland, OR
Roof +1st	10.8 factor and 0.95 factor based on results for large range opening wall supporting nothing and floor + wall above without roof dia
Roof +2st	2. Dolan and Pryor (1/20/06), "A Preliminary Report on Effect of Various Boundary Conditions" for ASTM E2125 Subcommittee
Whole Building System Effect Factor	3. Provides additional basis for 0.8 factor for wall supporting roof system only based on relevant results for BC 3 and BC 5)
Cont. Strg	4. Thurston (2002), "Full Sized House Cyclic Racking Test", Study Report No. 119 (2002), BRANZ, New Zealand
Int Braces	5. Reference 3 & 4 justify 1.0 partial restraint for 400 pil nominal bracing value)
	6. Reference 3 justifies system effect of 1.8, excluding contribution of interior partitions when only braced wall panels are counted at 1.8
	7. HUI (2001), "Whole Structure Testing - Three Reports, See also Payne (CSIRO) Masters Thesis and Crandell (2006) WDF article"
	8. (ref 1 and 5) justify 1.8 system factor for continuous and intermittent sheathing systems, further confirmed by CURREFEMA test -- 31
	9. Note: The system effect is based directly on whole building tests and does not include contribution of interior partitions (conservative).
	10. Note: "BRANZ" and "CSIRO" labels for verification)
	11. (JHC: 361/06)

Summarized Results (for >6:12 roof)

For example, if a continuous sheathed wall supporting a roof only has a maximum size opening with 65% clear opening height (a window), the net partial restraint factor and continuous sheathed factor would be effectively 0.8 x 1/0.9 = 1.0 (e.g., bracing would be considered as fully restrained). Thus, the 700 pil bracing method is fully utilized (not reduced for partial restraint) when continuous sheathing is used.

Required Length of Wall Bracing for Wind

Stories Above Braced Wall Line	Braced Wall Line Spacing	115 MPH			
		Lin. CB	DWB, WSP, WFR, JFB SPSR, MFS, CS SFB	CS-WSP, CS-G, CS-PF	Lin. CB
	10 ft	3.5	2.0	1.7	
	15 ft	3.0	2.9	2.4	
	20 ft	6.5	3.7	3.1	
	25 ft	7.9	4.5	3.8	
	30 ft	9.3	5.3	4.5	
	35 ft	10.7	6.1	5.2	
	40 ft	12.2	6.9	5.9	
	45 ft	13.6	7.8	6.6	
	50 ft	15.0	8.6	7.3	
	55 ft	16.4	9.4	8.0	
	60 ft	17.8	10.2	8.6	
	10 ft	6.7	3.8	3.2	
	15 ft	9.7	5.5	4.7	
	20 ft	12.5	7.1	6.1	
	25 ft	15.3	8.7	7.4	
	30 ft	18.0	10.3	8.7	
	35 ft	20.7	11.8	10.1	
	40 ft	23.4	13.4	11.4	
	45 ft	26.2	14.9	12.7	
	50 ft	28.9	16.5	14.0	
	55 ft	31.6	18.0	15.3	
	60 ft	34.3	19.6	16.6	
	10 ft	9.9	5.7	4.8	
	15 ft	14.3	8.2	6.9	
	20 ft	18.5	10.6	9.0	
	25 ft	22.6	12.9	11.0	
	30 ft	26.7	15.2	13.0	
	35 ft	30.7	17.6	14.9	
	40 ft	34.7	19.9	16.9	
	45 ft	38.8	22.1	18.8	
	50 ft	42.8	24.4	20.8	
	55 ft	46.8	26.7	22.7	
	60 ft	50.8	29.0	24.7	

Required Length of Wall Bracing for Wind

Stories Above Braced Wall Line	Braced Wall Line Spacing	110 MPH				115 MPH			
		Lin. CB	DWB, WSP, WFR, JFB SPSR, MFS, CS SFB	CS-WSP, CS-G, CS-PF	Lin. CB	DWB, WSP, WFR, JFB SPSR, MFS, CS SFB	CS-WSP, CS-G, CS-PF	Lin. CB	
	10 ft	3.2	1.8	1.5	3.5	2.0	1.7		
	15 ft	4.6	2.6	2.2	5.0	2.8	2.4		
	20 ft	5.9	3.4	2.9	6.5	3.7	3.1		
	25 ft	7.2	4.1	3.6	7.9	4.5	3.8		
	30 ft	8.5	4.9	4.1	9.3	5.3	4.5		
	35 ft	9.8	5.6	4.8	10.7	6.1	5.2		
	40 ft	11.1	6.4	5.4	12.2	6.9	5.9		
	45 ft	12.4	7.1	6.0	13.6	7.8	6.6		
	50 ft	13.7	7.8	6.7	15.0	8.6	7.3		
	55 ft	15.0	8.6	7.3	16.4	9.4	8.0		
	60 ft	16.3	9.3	7.9	17.8	10.2	8.6		
	10 ft	6.1	3.5	3.0	6.7	3.8	3.2		
	15 ft	8.8	5.0	4.3	9.7	5.5	4.7		
	20 ft	11.4	6.5	5.5	12.5	7.1	6.1		
	25 ft	14.0	8.0	6.8	15.3	8.7	7.4		
	30 ft	16.5	9.4	8.0	18.0	10.3	8.7		
	35 ft	19.0	10.8	9.2	20.7	11.8	10.1		
	40 ft	21.5	12.3	10.4	23.4	13.4	11.4		
	45 ft	23.9	13.7	11.6	26.2	14.9	12.7		
	50 ft	26.4	15.1	12.8	28.9	16.5	14.0		
	55 ft	28.9	16.5	14.0	31.6	18.0	15.3		
	60 ft	31.4	17.9	15.2	34.3	19.6	16.6		
	10 ft	9.1	5.2	4.4	9.9	5.7	4.8		
	15 ft	13.1	7.5	6.4	14.3	8.2	6.9		
	20 ft	16.9	9.7	8.2	18.5	10.6	9.0		
	25 ft	20.7	11.8	10.0	22.6	12.9	11.0		
	30 ft	24.4	13.9	11.9	26.7	15.2	13.0		
	35 ft	28.1	16.1	13.6	30.7	17.6	14.9		
	40 ft	31.8	18.2	15.4	34.7	19.9	16.9		
	45 ft	35.5	20.3	17.2	38.8	22.1	18.8		
	50 ft	39.1	22.4	19.0	42.8	24.4	20.8		
	55 ft	42.8	24.4	20.8	46.8	26.7	22.7		
	60 ft	46.4	26.5	22.6	50.8	29.0	24.7		

	Greater than 6:12 to 12:12	25 ft.	3,662 lbs.	15.3 ft.	8.7 ft.	7.4 ft.		
		30 ft.	4,321 lbs.	18.0 ft.	10.3 ft.	8.7 ft.		
		35 ft.	4,975 lbs.	20.7 ft.	11.8 ft.	10.1 ft.		
		40 ft.	5,628 lbs.	23.4 ft.	13.4 ft.	11.4 ft.		
		45 ft.	6,278 lbs.	26.2 ft.	14.9 ft.	12.7 ft.		
		50 ft.	6,927 lbs.	28.9 ft.	16.5 ft.	14.0 ft.		
		55 ft.	7,576 lbs.	31.6 ft.	18.0 ft.	15.3 ft.		
	60 ft.	8,224 lbs.	34.3 ft.	19.6 ft.	16.6 ft.			
	Roof plus Two Stories	* Adjusted Unit Shear Strength		240 plf.	420 plf.	420 plf.		
		6:12 and Less	10 ft.	2,281 lbs.	9.5 ft.	5.4 ft.	4.6 ft.	
			15 ft.	3,268 lbs.	13.6 ft.	7.8 ft.	6.6 ft.	
			20 ft.	4,202 lbs.	17.5 ft.	10.0 ft.	8.5 ft.	
			25 ft.	5,113 lbs.	21.3 ft.	12.2 ft.	10.3 ft.	
			30 ft.	6,012 lbs.	25.1 ft.	14.3 ft.	12.2 ft.	
35 ft.			6,905 lbs.	28.8 ft.	16.4 ft.	14.0 ft.		
40 ft.			7,793 lbs.	32.5 ft.	18.6 ft.	15.8 ft.		
45 ft.			8,679 lbs.	36.2 ft.	20.7 ft.	17.6 ft.		
50 ft.			9,563 lbs.	39.8 ft.	22.8 ft.	19.4 ft.		
55 ft.			10,445 lbs.	43.5 ft.	24.9 ft.	21.1 ft.		
60 ft.			11,326 lbs.	47.2 ft.	27.0 ft.	22.9 ft.		
Greater than 6:12 to 12:12		10 ft.	2,375 lbs.	9.9 ft.	5.7 ft.	4.8 ft.		
		15 ft.	3,434 lbs.	14.3 ft.	8.2 ft.	6.9 ft.		
		20 ft.	4,440 lbs.	18.5 ft.	10.6 ft.	9.0 ft.		
		25 ft.	5,426 lbs.	22.6 ft.	12.9 ft.	11.0 ft.		
		30 ft.	6,402 lbs.	26.7 ft.	15.2 ft.	13.0 ft.		
		35 ft.	7,371 lbs.	30.7 ft.	17.6 ft.	14.9 ft.		
		40 ft.	8,337 lbs.	34.7 ft.	19.9 ft.	16.9 ft.		
		45 ft.	9,301 lbs.	38.8 ft.	22.1 ft.	18.8 ft.		
		50 ft.	10,263 lbs.	42.8 ft.	24.4 ft.	20.8 ft.		
		55 ft.	11,223 lbs.	46.8 ft.	26.7 ft.	22.7 ft.		
		60 ft.	12,183 lbs.	50.8 ft.	29.0 ft.	24.7 ft.		

* Adjusted unit shear strength is based on nominal values (see "resistance tab") adjusted by 2.0 safety factor and partial restraint tabulated above.

** Required Wall Bracing Amounts are determined by dividing ASD required shear force (Tab 1. Load x ASD load factor) by adjusted unit shear strength and then dividing the result by system effect factor tabulated above.

Summarized Results (Benchmarking)

Required Length of Wall Bracing for Wind					
Stories above Braced Wall Line	Braced Wall Line Spacing	115 MPH			
		Intermittent Braces		Continuous Sheathing	
		LIB, GB	DWB, WSP, WFB, PS, PSP, HPS, CS SFB	CS-WSP, CS-G, CS-PF	
Roof Only	10 ft.	3 ft.	1 ft.	1 ft.	
	15 ft.	4 ft.	2 ft.	2 ft.	
	20 ft.	5 ft.	3 ft.	2 ft.	
	25 ft.	6 ft.	3 ft.	3 ft.	
	30 ft.	7 ft.	4 ft.	3 ft.	
	35 ft.	8 ft.	5 ft.	4 ft.	
	40 ft.	9 ft.	5 ft.	4 ft.	
	45 ft.	10 ft.	6 ft.	5 ft.	
	50 ft.	11 ft.	6 ft.	5 ft.	
	55 ft.	12 ft.	7 ft.	6 ft.	
60 ft.	13 ft.	8 ft.	6 ft.		
Roof plus One Story	10 ft.	6 ft.	3 ft.	3 ft.	
	15 ft.	9 ft.	5 ft.	4 ft.	
	20 ft.	11 ft.	6 ft.	5 ft.	
	25 ft.	14 ft.	8 ft.	7 ft.	
	30 ft.	16 ft.	9 ft.	8 ft.	
	35 ft.	18 ft.	11 ft.	9 ft.	
	40 ft.	21 ft.	12 ft.	10 ft.	
	45 ft.	23 ft.	13 ft.	11 ft.	
	50 ft.	25 ft.	15 ft.	12 ft.	
	55 ft.	28 ft.	16 ft.	14 ft.	
60 ft.	30 ft.	17 ft.	15 ft.		
Roof plus Two Stories	10 ft.	10 ft.	5 ft.	5 ft.	
	15 ft.	14 ft.	8 ft.	7 ft.	
	20 ft.	18 ft.	10 ft.	9 ft.	
	25 ft.	21 ft.	12 ft.	10 ft.	
	30 ft.	25 ft.	14 ft.	12 ft.	
	35 ft.	29 ft.	16 ft.	14 ft.	
	40 ft.	32 ft.	19 ft.	16 ft.	
	45 ft.	36 ft.	21 ft.	18 ft.	
	50 ft.	40 ft.	23 ft.	19 ft.	
	55 ft.	44 ft.	25 ft.	21 ft.	
60 ft.	47 ft.	27 ft.	23 ft.		

Benchmarking Conditions (from above inputs):	
# of stories:	2-story
wind speed:	115 mph
exposure:	B
wall height:	10 ft
ridge-eave ht:	10 ft
roof pitch:	<6:12

TABLE NOTES (subject to further simplifications):

(NOTE: Use of tabulated bracing amounts are further limited by 1 BWP at 250c)

1. Wind exposure B and a 30' mean roof height. For other conditions, multiply required bracing length by one of the following factors:

No. of Stories in Bldg	Mean Roof, ht h	Exposure/Height Factors, λ	
		Exp B	Exp C
1	15	1.0	1.2
2	22.5	1.0	1.3
3	30	1.0	1.4

n details

d load applied, respectively)

Zealanx

all-restrained nominal values)
 The Story Behind IRC Bracing Provisions*
 (see BRANZ, CSIRO, and CUREe/FEMA tabs)

	120 MPH			130 MPH			140 MPH			
	IRC Bracing Methods			IRC Bracing Methods			IRC Bracing Methods			
	CS-WSP, CS-G, CS-PF	LIB, GB	DWB, WSP, WFB, P BS, PSP, HPS, CS-SFB	CS-WSP, CS-G, CS-PF	LIB, GB	DWB, WSP, WFB, P BS, PSP, HPS, CS-SFB	CS-WSP, CS-G, CS-PF	LIB, GB	DWB, WSP, WFB, P BS, PSP, HPS, CS-SFB	CS-WSP, CS-G, CS-PF
	1.7	3.8	2.2	1.8	4.4	2.5	2.1	5.1	2.9	2.5
	2.4	5.4	3.1	2.6	6.4	3.7	3.1	7.4	4.2	3.6
	3.1	7.0	4.0	3.4	8.3	4.7	4.0	9.6	5.5	4.7
	3.8	8.6	4.9	4.2	10.1	5.8	4.9	11.7	6.7	5.7
	4.5	10.2	5.8	4.9	11.9	6.8	5.8	13.8	7.9	6.7
	5.2	11.7	6.7	5.7	13.7	7.8	6.7	15.9	9.1	7.7
	5.9	13.2	7.6	6.4	15.5	8.9	7.5	18.0	10.3	8.8
	6.6	14.8	8.4	7.2	17.3	9.9	8.4	20.1	11.5	9.8
	7.3	16.3	9.3	7.9	19.1	10.9	9.3	22.2	12.7	10.8
	8.0	17.8	10.2	8.7	20.9	12.0	10.2	24.3	13.9	11.8
	8.6	19.3	11.1	9.4	22.7	13.0	11.0	26.3	15.0	12.8
	3.2	7.3	4.2	3.5	8.5	4.9	4.1	9.9	5.7	4.8
	4.7	10.5	6.0	5.1	12.3	7.0	6.0	14.3	8.2	6.9
	6.1	13.6	7.8	6.6	16.0	9.1	7.7	18.5	10.6	9.0
	7.4	16.6	9.5	8.1	19.5	11.1	9.5	22.6	12.9	11.0
	8.7	19.6	11.2	9.5	23.0	13.1	11.2	26.7	15.2	13.0
	10.1	22.6	12.9	11.0	26.5	15.1	12.9	30.7	17.5	14.9
	11.4	25.5	14.6	12.4	30.0	17.1	14.6	34.8	19.9	16.9
	12.7	28.5	16.3	13.8	33.4	19.1	16.2	38.8	22.2	18.8
	14.0	31.4	18.0	15.3	36.9	21.1	17.9	42.8	24.4	20.8
	15.3	34.4	19.6	16.7	40.3	23.1	19.6	46.8	26.7	22.7
	16.6	37.3	21.3	18.1	43.8	25.0	21.3	50.8	29.0	24.7
	4.8	10.8	6.2	5.2	12.6	7.2	6.1	14.7	8.4	7.1
	6.9	15.6	8.9	7.6	18.3	10.4	8.9	21.2	12.1	10.3
	9.0	20.1	11.5	9.8	23.6	13.5	11.5	27.4	15.7	13.3
	11.0	24.6	14.1	12.0	28.9	16.5	14.0	33.5	19.1	16.3
	13.0	29.0	16.6	14.1	34.1	19.5	16.6	39.5	22.6	19.2
	14.9	33.4	19.1	16.2	39.2	22.4	19.1	45.5	26.0	22.1
	16.9	37.8	21.6	18.4	44.4	25.4	21.6	51.5	29.4	25.0
	18.8	42.2	24.1	20.5	49.5	28.3	24.1	57.4	32.8	27.9
	20.8	46.6	26.6	22.6	54.6	31.2	26.5	63.4	36.2	30.8
	22.7	50.9	29.1	24.7	59.8	34.1	29.0	69.3	39.5	33.7
	24.7	55.3	31.6	26.8	64.9	37.1	31.5	75.2	43.0	36.5

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Consistent with the original reason statement, the code change and public comment will not increase cost where builders and building officials have interpreted the code to allow individual walls or wall studs exceeding the 11'-7" limit provided the average story height remains within the limit. The code change may decrease the cost of construction for builders who have been forced to hire structural engineers to design portions of homes with bearing wall studs over 10 feet but not exceeding 12 feet. Estimates from Home Innovation Research Labs of the cost to retain a structural engineer to design the lateral system for a house ranged from \$436 to \$750.

RB46-19

IRC@: TABLE R301.5

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)

USE	LIVE LOAD
Uninhabitable attics without storage ^b	10
Uninhabitable attics with limited storage ^{b, g}	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks ^e	40
Fire escapes	40
Guards and handrails ^{d, i}	200 ^{h, i}
Guard in-fill components ^f	50 ^h
Handrails ^d	200 ^h
Passenger vehicle garages ^a	50 ^a
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40 ^c

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm², 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section R507.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.
- g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:
 - 1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
 - 2. The slopes of the joists or truss bottom chords are not greater than 2 inches vertical to 12 units horizontal.
 - 3. Required insulation depth is less than the joist or truss bottom chord member depth.
 The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.
- h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.
- i. For a guard system not required to serve as a handrail, a single concentrated load applied at any point along the top, in the vertical downward direction and in the horizontal direction toward the lower surface. For a guard also serving as a handrail, a single concentrated load applied in any direction at any point along the top.

Reason: The purpose of this proposal is to revise the load on guard systems for one- and two-family dwellings to align with common industry practice. Extensive discussion has occurred in recent code cycles on load requirements and details for guard systems on decks accessory to one- and two-family dwellings. In particular, the directions in which the 200 pound guard load needs to be applied has been a topic of debate. The IRC and IBC define a guard as “a building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.” The ASCE definition of a guardrail system is very similar. Clearly, a fall from the edge of an unprotected deck to the ground, which can be as much as 10 feet or more, carries a much greater risk of injury than a fall backwards onto the surface of the deck, which is only a few feet.

Further, a guard system can be constructed without a handrail, as under both the IRC and IBC a handrail is only required at a flight of stairs, a ramp,

a stepped aisle, or a ramped aisle. Nor is the top rail of a guard system required to be graspable by occupants of a deck or other elevated walking surface, unless the guard is specifically designed to also serve as a handrail. In fact, a guard need not even have a top rail unless specifically required by the codes or the reference standards for guard systems, or desired as part of the design of the guard system.

As such, industry standards such as ASTM D7032 for wood and plastic composite decks boards and guards (referenced in both the IBC and IRC) and code evaluation acceptance criteria such as ICC-ES AC 174 for deck boards and guardrails, call for applying the 200 pound load in the outward and downward directions only, not inward or upward and certainly not parallel to the guard. Despite this apparent deviation from the IRC, IBC and ASCE 7 load requirements, thousands of guard systems, when designed, tested, and constructed in accordance with these industry standards and acceptance criteria and used properly, have performed exceptionally well and have protected occupants of decks against falls from the deck.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change will recognize existing practices in the design and testing of guard systems as specified in ASTM D7032, ICC-ES AC 174 and other industry standards for guard systems and components. Manufacturers with existing products designed and tested to those standards will remain compliant with the IRC and will not need to conduct additional engineering or testing. If this change is not approved, manufacturers may eventually be required to test or design their products for additional load directions, which would substantially increase cost.

RB46-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposed code text confuses what is already in the code. This should be coordinated with ASCE 7. Residential is not so different from commercial. (Vote: 7-4)

Assembly Action:

None

RB46-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R301.5

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)**

USE	LIVE LOAD
Uninhabitable attics without storage ^b	10
Uninhabitable attics with limited storage ^{b, g}	20
Habitable attics and attics served with fixed stairs	30
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Fire escapes	40
Guards ⁱ	200 ^{h, i}
Guard in-fill components ^f	50 ^h
Handrails ^d	200 ^h
Passenger vehicle garages ^a	50 ^a
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40 ^c

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm², 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section R507.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.
- g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:
 - 1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
 - 2. The slopes of the joists or truss bottom chords are not greater than 2 inches vertical to 12 units horizontal.
 - 3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.
- h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.
- i. ~~For~~ Where the top of a guard system is not required to serve as a handrail, a the single concentrated load shall be applied at any point along the top, in the vertical downward direction and in the horizontal direction away from the walking toward the lower surface. ~~For~~ Where the top of a guard is also serving as the a handrail, a single concentrated load shall be applied in any direction at any point along the top. Concentrated load shall not be applied concurrently.

Commenter's Reason: The purpose of this public comment is to clarify the intent of the new footnote while preserving the original sense of the BCAC and the Deck Code Coalition that the critical directions of fall against which a guard provides protection are horizontally outward from the

adjacent walking surface and vertically downward towards a lower surface. “Guard system” is changed to “guard” consistent with the rest of the IRC. The footnote is revised to specify the application of the 200# load using “shall be applied” consistent with other footnotes to Table R301.5. Finally, a note that the specified directions of loading are to be considered separately, not concurrently. These revisions

Concerns have been raised about the effect over time of occupants pulling inward (or upward) on the guard and causing the post connection to loosen. Proposal RB185-19 from the Deck Code Coalition, which was approved by the IRC-Building committee, introduces a set of general minimum requirements for guard post attachments to deck framing. These requirements include, among other criteria, a minimum 4x4 post size, a prohibition on notching of posts, and a prohibition on connections relying solely on use of fasteners in end grain withdrawal. Just the latter provision alone will require guard post connections to deck framing use a combination of fasteners loaded in shear and withdrawal, reducing the risk of working loose the connectors loaded in withdrawal. The prohibition on notching reduces the risk of a split developing in the post that could grow larger with repeated loading.

Given that several industry standards or acceptance criteria require testing only in the horizontal outward and vertical downward directions, and given the IRC provides clear guidance on where a handrail is required, the BCAC believes the committee is incorrect that this change introduces confusion. In fact, it reduces confusion and aids enforcement by extending the principle – already recognized by the IRC – that guards and handrails serve different purposes, and by correlating the IRC with established ASTM standards, ICC acceptance criteria, and common practice throughout the residential and deck-building industry.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is intended as a clarification of requirements.

Public Comment# 1354

RB53-19

IRC@: R302.1, [RB] 202

Proposed Change as Submitted

Proponents: David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

2018 International Residential Code

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwelling*s, townhouses and accessory buildings shall comply with Table R302.1(1); or dwellings and townhouses equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling or townhouse* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings or townhouses on the *lot*.

The distance shall be measured at a right angle from the face of the wall.

Reason: Prior to the 2015 IRC, Section R302.2 required each townhouse to be considered a separate building and be separated by fire-resistance-rated walls meeting requirements for exterior walls, with an exception to provide a fire-resistance-rated common wall. The 2015 IRC revised this section to only deal with common walls and a reference to exterior walls was removed. Since R302.1 only requires fire-resistance-rated exterior walls for *dwelling*s and accessory buildings, all townhouse exterior wall requirements were essentially removed from the code since a townhouse does not meet the definition of a *dwelling*. Prior to 2015 IBC, an imaginary line would be established between each townhouse since they were considered separate buildings and fire separation distance would be measured to the imaginary line, and it is believed that most jurisdictions still enforce this way.

This proposal brings back the 2012 townhouse exterior wall requirements that are assumed to have been inadvertently removed from the code. It does this by adding townhouses to the scoping of R302.1 for exterior walls and by revising the definition of fire separation distance to include imaginary lines between townhouses (rather than calling townhouses separate buildings, which they are not). Townhouse exterior walls that are adjacent to lot lines would meet exterior wall requirements based on fire separation distance to the lot lines. Townhouse exterior walls that are adjacent to other townhouses, would meet exterior wall requirements based on fire separation distance to the imaginary line between two townhouses. See Figures 1 and 2 below for application examples for this proposal. This proposal is necessary to fill the current hole in the code regarding exterior wall requirements for townhouses.

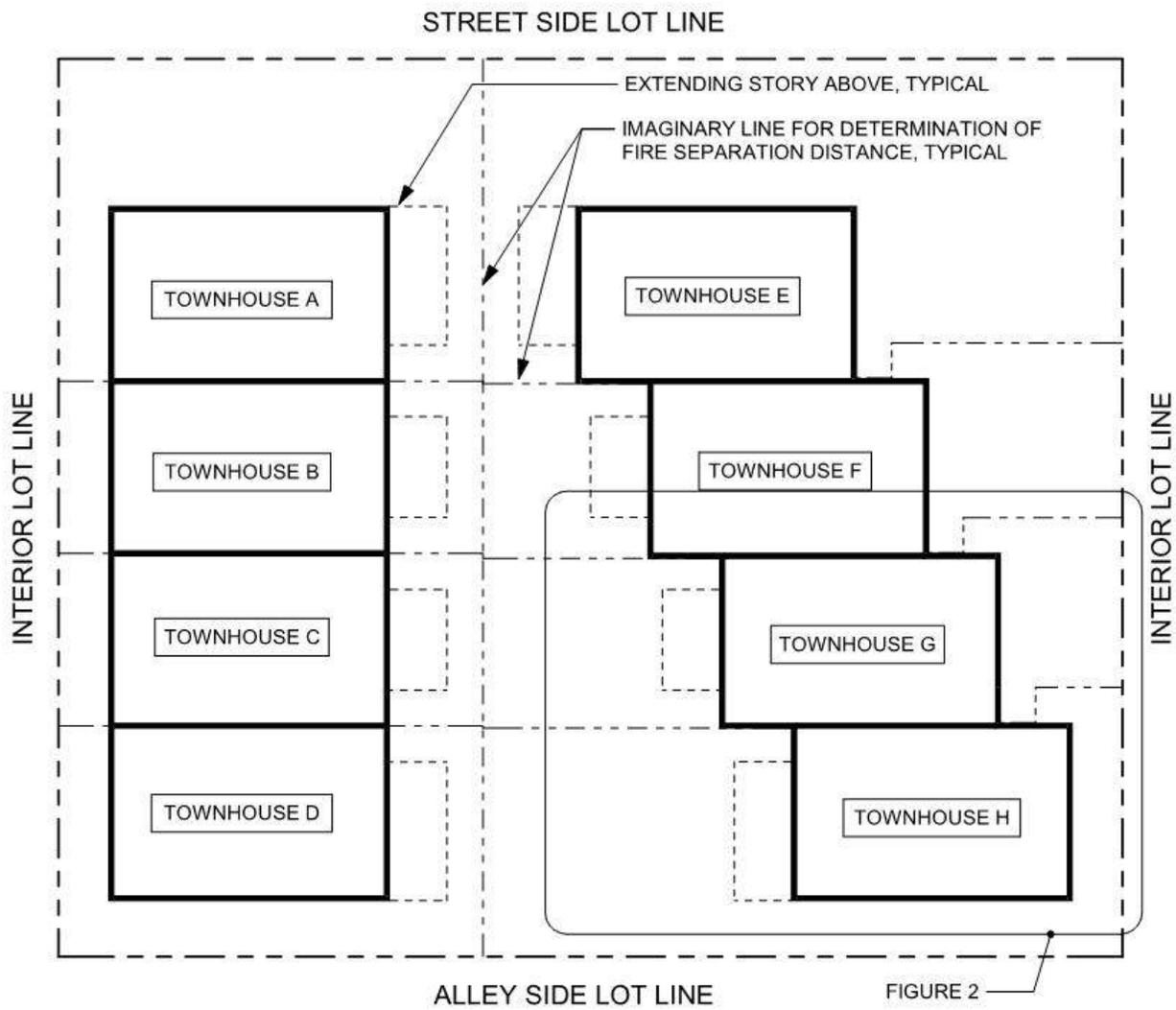
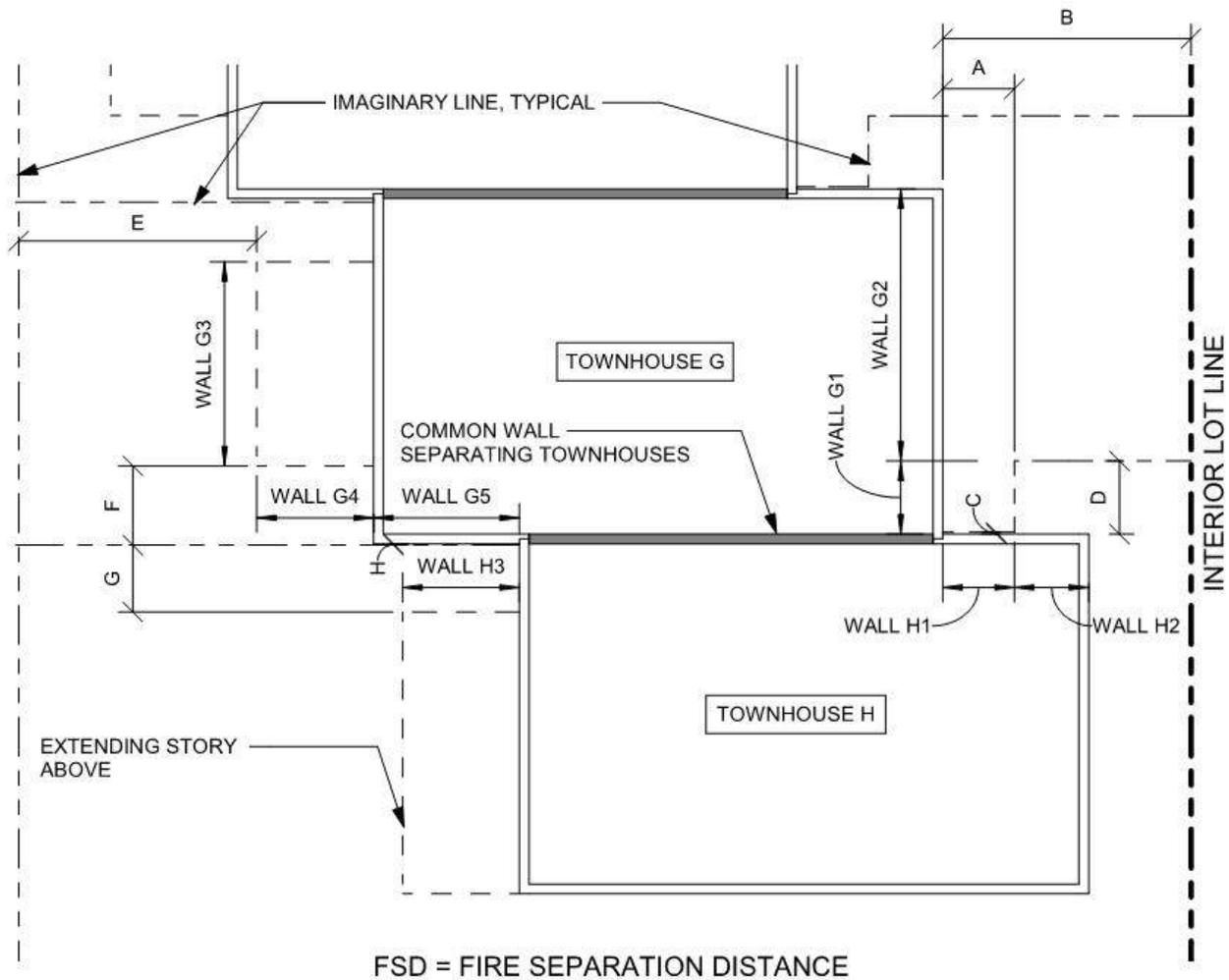


FIGURE 1 - IMAGINARY LINES BETWEEN TOWNHOUSES



- A = FSD FOR WALL G1
- B = FSD FOR WALL G2
- C = FSD = 0 FOR WALL H1
- D = FSD FOR WALL H2
- E = FSD FOR EXTENDING STORY WALL G3
- F = FSD FOR EXTENDING STORY WALL G4
- G = FSD FOR EXTENDING STORY WALL H3
- H = FSD = 0 FOR WALL G5

FIGURE 2 - EXAMPLE FIRE SEPARATION DISTANCES

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal brings back previous code requirements that I believe are currently being enforced due to the lack of specific townhouse exterior wall requirements in the current code, so there should be no increase or decrease in the cost of construction.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal is a problem as there are many other places where it would follow that this term should be inserted, but it is

Individual Consideration Agenda

Public Comment 1:

IRC@: R302.1, [RB] 202, R302.1.1 (New)

Proponents:

David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwelling*s, *townhouses* and accessory buildings shall comply with Table R302.1(1); or *dwelling*s and *townhouses* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling or townhouse* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings or *townhouses* on the *lot*.

The distance shall be measured at a right angle from the face of the wall.

R302.1.1 Townhouses on the same lot. For the purposes of determining *fire separation distance* and the requirements of Section R302.1, *townhouses* on the same *lot* shall have imaginary lines established. Imaginary lines shall begin at the ends of walls separating townhouses required by Section R302.2 and shall extend to a *lot line* or another imaginary line.

Commenter's Reason: The intent of this public comment is to improve on the original proposal by addressing issues raised at the public comment hearings and by emphasizing the need for this code change. This is accomplished as follows:

1. The committee thought the proposal was unnecessary since there will be a lot line between townhouses to measure fire separation distance to, so there would be no need for an imaginary line. First, the IRC does not require a lot line between townhouses nor does it require property lines between townhouses, which are considered to be lot lines by some jurisdictions. A townhouse building can certainly be constructed with one owner and individual townhouses being rented, with no property lines between units. Second, even if there are property lines, some jurisdictions don't consider these to be lot lines and regulate based on the lot designated for development - in Denver this called a zone lot. In this case, property lines (if they exist) are used by the jurisdiction for tax assessment purposes and are often established after the building permit is issued, so they are of no use for building code requirements. In summary, where there is no lot line between townhouses, there is a need to establish an imaginary line to determine fire separation distance and exterior wall requirements. This public comment dictates how these lines are established through a new section R302.1.1 for townhouses on the same lot. If a jurisdiction considers property lines to be lot lines, there are no townhouses on the same lot and this new section does not apply.

2. Opponents had a concern that this proposal brings back the "separate building" concept of a townhouse, but that was/is not the intent and this proposal/public comment in no way creates separate buildings for each townhouse unit - it simply establishes how exterior wall fire-

resistant construction requirements are determined. The original reason statement even stated that townhouses are not separate buildings, so this should not have been an issue. To avoid any interpretation that exterior walls are required where units adjoin (i.e. creating separate buildings), this public comment requires that imaginary lines start at the ends of walls that separate townhouses rather than continuing through the townhouses.

3. The committee thought it was unnecessary to add "townhouses" to this section since "townhouses" could be inserted in many sections of the code where only "dwellings" are mentioned. For example, the means of egress section only mentions "dwellings", but it is obvious that "townhouses" need a means of egress and requirements are the same. The difference here is that there are no code requirements for how to apply exterior wall requirements to townhouses. Do you regulate based on the entire townhouse building or based on each individual townhouse unit? This public comment makes it clear that exterior wall requirements are applied to individual townhouse units, as has been required in the past.

Please support this public comment to bring clarity to the code regarding townhouse exterior wall fire-resistant construction requirements. For cases where lot lines do not exist between townhouses, there is a definite need for this code change since the code is silent on how to apply the exterior wall requirements. For cases where lot lines exist between townhouses, nothing changes from the current code since fire separation distance would be measured to these lot lines.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The cost of construction should not change for reason given in the original proposal.

Public Comment# 1344

RB56-19

IRC@: R302.2.2

Proposed Change as Submitted

Proponents: David Renn, PE, SE, City and County of Denver, representing City and County of Denver (david.renn@denvergov.org)

2018 International Residential Code

Revise as follows:

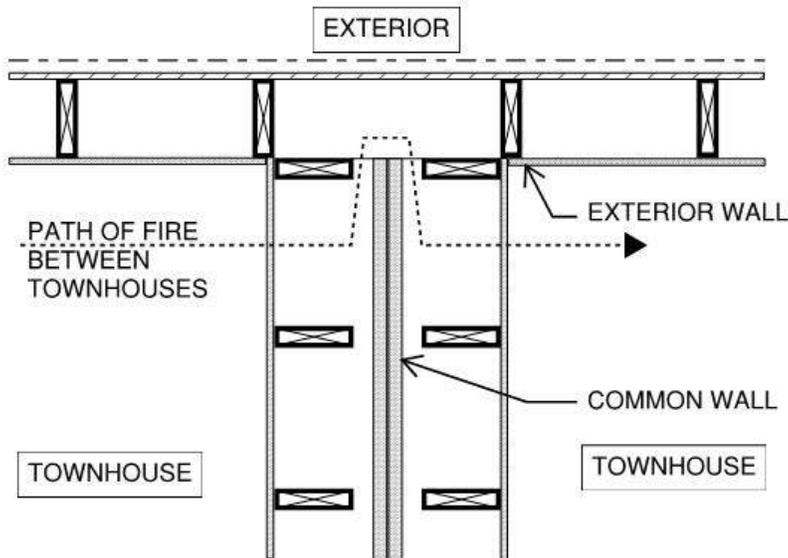
R302.2.2 Common walls. Common walls separating townhouses shall be assigned a fire-resistance rating in accordance with Item 1 or 2-2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two townhouses shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. ~~The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing.~~ Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two two-inch nominal thickness wood studs.

Reason: The code currently allows a townhouse common wall to stop at the interior face of the exterior wall, which can create a path for a fire to spread from one townhouse to the next through the exterior wall. A typical common wall construction is two layers of gypsum board in metal H-studs that are connected to stud walls on either side for stability only, with a gap between the gypsum board and the stud walls. With the gap in this configuration, there is a path a fire can take that is only protected by two layers of 1/2" non-classified gypsum board (or other sheathing) - one on the stud wall adjacent to the common wall on the fire side and one on the same wall of the adjacent townhouse. Two layers of 1/2" gypsum board only provides approximately 30 minutes of fire protection until a fire can spread to the next townhouse. See figure below for clarification of this type of common wall construction.

This proposal requires common walls to continue to the exterior sheathing of the exterior wall, which will eliminate the path of fire described above and will provide the intended fire rating duration of the common wall. For solid exterior walls, such as concrete or masonry, this proposal allows common walls to stop at the inside face since a path for fire to spread from townhouse to townhouse doesn't exist in a solid exterior wall. The exception allows (2) 2x wood studs to be used to extend the common wall through the exterior wall stud cavity. Typical wood studs have a char rate of approximately 1.5" per hour, so this provides the required fire-resistance rating of the common wall.



Cost Impact: The code change proposal will not increase or decrease the cost of construction. The common wall extent requirement in this proposal is the typical way common walls are constructed, so there should be no change in construction or cost of construction.

RB56-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This provides continuity of common walls that is not provided by current code text. The exception is appropriate. (Vote: 11-0)

Assembly Action: **None**

RB56-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R302.2.2

Proponents:

Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R302.2.2 Common walls. Common walls separating *townhouses* shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two *townhouses* shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls where voids in the exterior wall at the end of the common wall are fireblocked. ~~if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two two-inch nominal thickness wood studs.~~

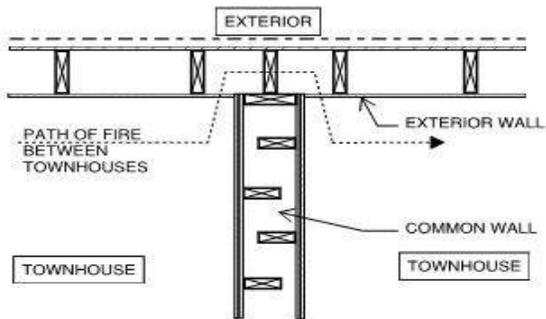
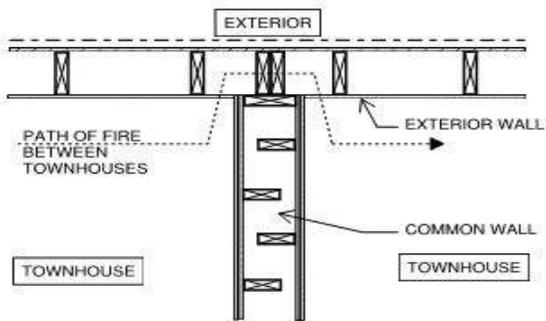
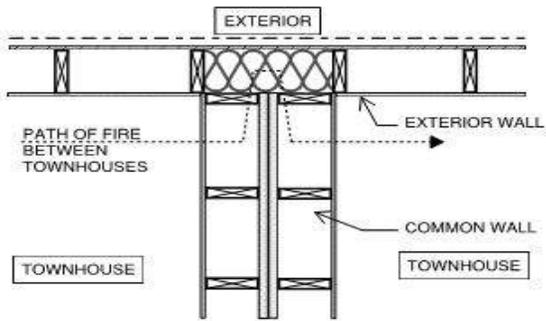
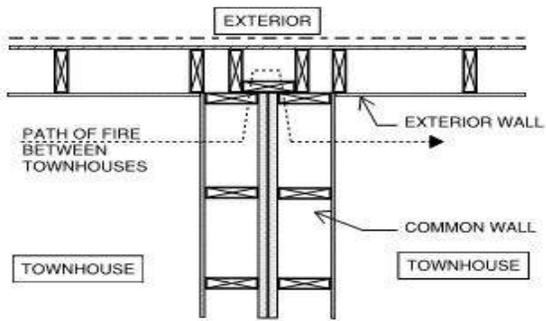
Commenter's Reason: We understand what the proponent was trying to achieve and support the overall proposal, but believe the language in the exception caused an unintended interpretation issue. Additionally we struggling to understand the constructability of the example the proponent provided.

This public comment addresses the interpretation issue of what "filled" actually means in the exception. WABO members indicated it meant the cavity should be completely blocked starting with a minimum of two, two inch wood studs. This cavity could be required to be blocked with 4, 5, or 6, wood studs. We do not believe this was the intent of the proposal and believe the language provided in this public comment provides a greater clarity for these areas.

This public comment identifies that the issue the proponent was trying address can be mitigated with fireblocking. Fireblocking is a defined term in the IRC and is what should be identified to use in these areas.

This public comment is only a clarification to the exception language in the approved proposal. Please review the diagrams to see some examples of

how this exception can apply.



Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is providing code language to a common construction practice and will not increase the cost of construction.

RB58-19

IRC@: TABLE R302.1(1), TABLE R302.1(2)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

**TABLE R302.1(1)
EXTERIOR WALLS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{a, b}	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ~~gable~~ vent openings are not installed in the overhang or in any gable end walls that are common to attic areas.

**TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet ^a
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{b, c}	2 feet ^a
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet ^a
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet ^a

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ~~gable vent openings are not installed in the overhang or in any gable end walls that are common to attic areas.~~

Reason: Staff continues to get questions regarding these footnotes. The existing language remains unclear, despite recent attempts to fix it. Ray Allshouse, the proponent of the code change that brought this language into the code, was contacted. He indicated that the intent was that if there were no vents at the underside of the overhang, or in any gable end walls (both of which would allow fire to freely move into attic areas), then there should be no requirement to rate the underside of the overhang. Mr. Allshouse also indicated that this concept could be applied gable, hip and any other roof style with overhangs. Where additional attic ventilation is required to make up for the loss of vents at overhangs where fire-separation distance is an issue in accordance these tables and footnotes, additional vents could be added at the underside of eaves in other areas of the dwelling where the fire-separation distance is not an issue, or at roof ridges.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This code change is a clarification of current code requirements.

RB58-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are improvements that need to be made to make this a complete code change. The proponent requested disapproval.
(Vote: 11-0)

Assembly Action:

None

RB58-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R302.1(1), TABLE R302.1(2)

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**TABLE R302.1(1)
EXTERIOR WALLS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls ^c	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{a, b}	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the ~~eave~~ overhang where ~~gable~~ vent openings are not installed and the overhang is protected with fire-retardant-treated-wood, non-combustible material, or gypsum sheathing.
- c. Where the fire separation distance for the gable end wall is less than or equal to 3 feet, gable end vents shall not be permitted.

**TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls ^d	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet ^a
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{b, c}	2 feet ^a
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet ^a
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet ^a

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the ~~rake~~ overhang where vent openings are not installed and the overhang is protected with fire-retardant-treated-wood, non combustible material or gypsum sheathing in the overhang or in any gable end walls that are common to attic areas.
- d. Where the fire separation distance for a gable end wall is less than or equal to 3 feet, gable end vents shall not be permitted.

Commenter's Reason: The original submittal contained several errors. This comment corrects the errors and recognizes that gable end walls are not projections but walls.

The additional language for the FRTW, non-combustible material and gypsum sheathing is to recognize that any material could be used including vinyl or PVC offering little to no protection to the attic space. As 13R and 13D do not require the attic space be sprinkled.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Merely provides another option to user of the code

Public Comment# 1653

Public Comment 2:

IRC@: TABLE R302.1(2)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet ^a
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{b, c}	2 feet ^a
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet ^a
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet ^a

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where vent openings are not installed in the overhang or in any gable end walls that are common to attic areas.

Commenter's Reason: During the testimony an error was noted in the deleted language in Footnote C. We are correcting that error. Please also see the original proposal reason statement.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change and public comment are a clarifications of current code requirements.

Public Comment# 1248

RB59-19

IRC@: R302.2.3.1 (New)

Proposed Change as Submitted

Proponents: Kirk Nagle, representing Myself (knagle@auroragov.org)

2018 International Residential Code

Add new text as follows:

R302.2.3.1 Occupied Roof Rated Separation. Townhome separation, where the roof is intended to be occupied, shall continue the common wall between units to a height of 8 feet above the walking surface with a minimum one hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the *International Building Code* and shall have noncombustable faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials.

Reason: Occupied roofs are a new building element that has the potential to cause connected townhomes to be at a significant risk of fire hazard. In reviewing plans and looking at the current code requirements, the potential for risk of fire conflagration to involve connected townhome units does not seem to be addressed by the 2018 IRC. Fire data from the NFPA related to fires caused by gas grills alone would suggest that not having some protection to connected units leaves the occupants at risk. People will have the gas grills, charcoal grills and other fire related uses to occur on the occupied roofs. Even when fire sprinklers are installed the potential fire propagation from one unit to another is not addressed. Loss of life or even just losing the use of a home after a fire is significant. This proposal would help increase the chance that the fire would not involve connect units and allow the fire department response to contain the fire on the original unit.

NFPA Report fact sheet U.S. Home Fires Involving Grills

From 2011–2015, U.S. fire departments responded to an average of 9,600 home1 fires involving grills, hibachis, or barbecues per year. That number included an average of 4,100 structure fires and 5,500 outside or unclassified fires. These 9,600 fires caused annual averages of 10 civilian deaths, 160 reported civilian injuries, and \$133 million in direct property damage. ffAlmost all the losses resulted from structure fires.

ffJuly (17%) was the peak month for grill fires, followed by May (14%), June (14%), and August (13%). Three percent of the fires occurred in each of the winter months of December, January, and February.

Causes of Grill Fires

Gas vs. Solid-Fuel Grills

Five out of six (82%) grills involved in home fires were fueled by gas, while 14% used charcoal or other solid fuel. Gas grills were involved in an average of 7,900 home fires per year, including 3,300 structure fires and 4,700 outdoor fires annually. Leaks or breaks were primarily a problem with gas grills. Twelve percent of gas grill structure fires and 24% of outside gas grill fires were caused by leaks or breaks.

Charcoal or other solid-fuel grills were involved in 1,300 home fires per year, including 600 structure fires and 700 outside fires annually.

Fire and Non-Fire Emergency Room Visits Due to Grills

From 2012–2016, an average of 16,600 patients per year went to emergency rooms because of injuries involving grills.2 Half (8,200 or 49%) of the injuries were thermal burns, including burns both from fire and from contact with hot objects. About 4,500 of the thermal burns were caused by such contact or other non-fire events.

Children under age 5 accounted for an average of 1,600 or one-third (35%) of the contact-type burns. The burns typically occurred when someone, often a child, bumped into, touched, or fell on the grill, grill part, or hot coals. Keep children away from the grill.

Cost Impact: The code change proposal will increase the cost of construction

The cost of construction will be increased but the amount is not static because it is based on the variables of the finishes and type of construction.

RB59-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proponent said that such problems may occur in the future. We should not look for a problem that does not exist. This is incomplete. There are other types of fire issues on the roof that could be addressed, such as cigarettes, mulch, fire pits, etc. This proposal is moving in the right direction but is not ready for prime time. (Vote: 6-4)

Individual Consideration Agenda

Public Comment 1:

IRC@: R302.2.3.1 (New)

Proponents:

Kirk Nagle, representing Myself (knagle@auroragov.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R302.2.3.1 Occupied Roof Separation. Where the roof of a townhouse is built to be occupied, a separation wall not less than 5 feet in height shall be built as a parapet and the wall shall be one hour fire-resistance-rated in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code. The parapet wall shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials.

Commenter's Reason: Occupied roofs are a new building element that has the potential to cause connected townhomes to be at a significant risk of fire hazard. In reviewing plans and looking at the current code requirements, the potential for risk of fire conflagration to involve connected townhome units does not seem to be addressed by the 2018 IRC. Fire data from the NFPA related to fires caused by gas grills alone would suggest that not having some protection to connected units leaves the occupants at risk. People will have the gas grills, charcoal grills and other fire related uses to occur on the occupied roofs. Even when fire sprinklers are installed the potential fire propagation from one unit to another is not addressed. Loss of life or even just losing the use of a home after a fire is significant. This proposal would help increase the chance that the fire would not involve connected units and allow the fire department response to contain the fire on the original unit.

This proposal does not only pertain to grills but all of the decorative burning devices and fireworks that occupants of adjoining townhouses will bring up on their occupied roof decks. The committee did not understand that even though I was using data related to grills the problem is very real. Parapets were originally required to reduce the fires impact on adjoining units and now that building designers are building occupied on townhouses it is even more of a threat to life and the building itself.

This is not an if, but a when it happens. Mitigating the damage to adjoining structures and to the very lives of the occupants of the townhouses is why this code change was written. Parapets are required but you can remove them if you follow the code exception, but that exception ignores the reality that the roof would be an occupied space. Even though fire sprinklers are required they would have no effect on a roof fire, started on one unit, that would sweep across the whole building, putting lives and property in severe danger.

This code change will save lives please vote in favor of this code change and overturn the committee.

NFPA Report fact sheet U.S. Home Fires Involving Grills

From 2011–2015, U.S. fire departments responded to an average of 9,600 home fires involving grills, hibachis, or barbecues per year. That number included an average of 4,100 structure fires and 5,500 outside or unclassified fires. These 9,600 fires caused annual averages of 10 civilian deaths, 160 reported civilian injuries, and \$133 million in direct property damage.

ffAlmost all the losses resulted from structure fires.

ffJuly (17%) was the peak month for grill fires, followed by May (14%), June (14%), and August (13%). Three percent of the fires occurred in each of the winter months of December, January, and February.

Causes of Grill Fires

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Five out of six (82%) grills involved in home fires were fueled by gas, while 14% used charcoal or other solid fuel.

Gas grills were involved in an average of 7,900 home fires per year, including 3,300 structure fires and 4,700 outdoor fires annually. Leaks or breaks were primarily a problem with gas grills. Twelve percent of gas grill structure fires and 24% of outside gas grill fires were caused by leaks or breaks.

Charcoal or other solid-fuel grills were involved in 1,300 home fires per year, including 600 structure fires and 700 outside fires annually.

Fire and Non-Fire Emergency Room Visits Due to Grills

From 2012–2016, an average of 16,600 patients per year went to emergency rooms because of injuries involving grills.² Half (8,200 or 49%) of the injuries were thermal burns, including burns both from fire and from contact with hot objects. About 4,500 of the thermal burns were caused by such contact or other non-fire events. Children under age 5 accounted for an average of 1,600 or one-third (35%) of the contact-type burns. The burns typically occurred when someone, often a child, bumped into, touched, or fell on the grill, grill part, or hot coals. Keep children away from the grill.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost of this proposal is significant with design and construction.

Public Comment# 2112

RB60-19

IRC@: R302.2.6

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., representing Self (jeff.shapiro@intlcodeconsultants.com)

2018 International Residential Code

Revise as follows:

R302.2.6 Structural independence. Each individual *townhouse* shall be structurally independent.

Exceptions:

1. Foundations supporting *exterior walls* or common walls.
2. Structural roof and wall sheathing from each unit fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. *Townhouses* separated by a common wall as provided in Section R302.2.2, Item 1 or 2.
6. *Townhouses* protected by a fire sprinkler system complying with Section P2904 or NFPA 13D.

Reason: The IBC now allows townhouses to be built without structural independence provided that height and area limits for the overall townhouse building are not exceeded. This is true because the firewall requirement to separate units is no longer applicable in such cases. Therefore, only the 1-hour dwelling unit requirement applies, and that assembly is a fire barrier, which has no structural independence requirement. For reference IBC Section 706.1.1, Exception 2 states:

Fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the code official's review and approval, he or she shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.

It makes no sense for the IRC to be more restrictive than the IBC with respect to requiring structural independence when townhouses are sprinklered.

Disclosure: although I am a consultant to the National Fire Sprinkler Association, this proposal is submitted on my own behalf and was not reviewed or endorsed by NFSA prior to submittal.

Cost Impact: The code change proposal will decrease the cost of construction
Construction costs are reduced, consistent with the IBC, based on the allowance to not require structural independence of townhouse units.

RB60-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is a needed clarification to the code that encourages the use of fire sprinkler systems in jurisdictions where fire sprinkler systems are not required. (Vote: 8-3)

Assembly Action: **None**

RB60-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Skalko, representing Masonry Alliance for Codes and Standards (svskalko@svskalko-pe.com)

requests Disapprove

Commenter's Reason: RB60-19 should be disapproved for lack of technical justification. This proposal will exempt townhouses from the requirement for structural independence based on providing sprinkler protection in accordance with Section P2904 or NFPA 13D. While sprinkler protection has been shown to control fires and reduce the impact of fire to the interior of buildings, studies by NFPA have also documented that operating effectiveness of sprinkler protection IS NOT 100%. Reliance on sprinklers operating less than 100% is not equal to in-place physical features of structural independence for the building construction .

Further, the sprinkler protection in P2904 and NFPA 13D will permit sprinkler protection to be omitted from attics and crawl spaces without fuel fire equipment, garages, carports, exterior porches, mud rooms adjacent to exterior doors and similar spaces. Omitting sprinkler protection from these areas while exempting the structural independence results in a reduction in the overall level of fire safety prescribed by the present code requirements.

Finally, the IRC Building Committee reason for approval also does not reflect any technical justification. They state the code change is "a needed clarification to the code that encourages the use of a fire sprinkler system in jurisdictions where fire sprinklers are not required". The code change does not provide any clarification for structural independence of townhouses. It reduces the present level of fire safety in the code through the use of sprinkler protection that is not provided throughout the townhouse.

Recommend RB60-19 be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1849

RB66-19

IRC@: R302.3

Proposed Change as Submitted

Proponents: Stephen Thomas, representing Himself (sthomas@coloradocode.net)

2018 International Residential Code

Revise as follows:

R302.3 Two-family dwellings. *Dwelling units* in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code. Such separation shall be provided regardless of whether a lot line exists between the two dwelling units or not. Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the *exterior wall*, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

Exceptions:

1. A fire-resistance rating of 1/2 hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.
2. Wall assemblies need not extend through *attic* spaces where the ceiling is protected by not less than 5/8-inch (15.9 mm) Type X gypsum board, an *attic* draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the *dwellings* and the structural framing supporting the ceiling is protected by not less than 1/2-inch (12.7 mm) gypsum board or equivalent.

Reason: The intent of this proposal is to clarify the separation between the dwelling units in a two-family dwelling. A proposal (RB52-16) was submitted last cycle that required two 1-hour walls between the units if a lot line existed and a single wall if a lot line was not present. The committee disapproved the change because they felt that the revised language complicated the existing requirements in the code. The proposal intends to simplify the requirements. The presence of a lot line between the dwelling units does not change the impact of fire spread from one unit to another. The fire does not know whether there is a lot line there or not. This issue has been raised for many years. That indicates that there is a serious problem with this requirement. The proposal clearly indicates that the one-hour separation is required regardless of the presence of a lot line. Many people, including the commentary, state that if there is a lot line between the two units, that two 1-hour walls are required. I challenge anyone to show me where in Section 302.3 it states that. This section only requires a single 1-hour wall. There is also no requirement that states that the two units are separate buildings similar to what we used to do with townhouses. So, the application of Section 302.1 is not referenced in this section. The definition of dwelling states that it is any building that contains one or two dwelling units... It is a single building, not two separate buildings as some would like to say.

Cost Impact: The code change proposal will decrease the cost of construction. Since many jurisdictions are requiring two 1-hour walls when a lot line is present, the cost of the separation will be reduced with this change.

RB66-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The code is silent on this issue and adding this doesn't solve it. It is allowable under the code and this simply forces interpretation. (Vote: 9-1)

Assembly Action:

None

RB66-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Thomas, representing Colorado Chapter (stthomas@coloradocode.net)

requests As Submitted

Commenter's Reason: The committee reason actually supports our proposal. The code is silent on the lot line issue. I agree that the code states that the separation is only required to be a one-hour fire-resistant rated assembly. However, there is an ICC committee interpretation and ICC educational materials state that if a lot line is located between the two dwelling units, they are considered two separate buildings and must have two one-hour walls at the separation. Many people agree with this position. We argue that the fire doesn't know whether there is a lot line there or not. The lot line is just used to determine ownership. We submitted a change to say just that last cycle and it was disapproved. This proposal is intended to clarify the issue so different interpretations are eliminated.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. For those areas requiring the double wall will be able to go to a single wall which will decrease the cost of construction.

Public Comment# 1564

RB67-19

IRC@: R302.4.1

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., representing Self (jeff.shapiro@intlcodeconsultants.com)

2018 International Residential Code

Revise as follows:

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, or listed fire sprinkler piping, the annular space shall be protected as follows:

1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided that both of the following are complied with:
 - 1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
 - 1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm²).
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time temperature fire conditions under a positive pressure differential of not less than 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

Reason: Listed fire sprinkler piping is ignition resistant and will not sustain combustion. Allowing common fire sprinkler piping to protect multiple units in a townhouse can significantly reduce installation costs, and the IBC now allows penetration of townhouse separation walls in any townhouse that does not exceed the height and area limits. For reference IBC Section 706.1.1, Exception 2 states:

Fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the code official's review and approval, he or she shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.

It makes no sense for the IRC to be more restrictive than the IBC with respect to allowing penetration of sprinkler piping through townhouse separation walls.

Disclosure: although I am a consultant to the National Fire Sprinkler Association, this proposal is submitted on my own behalf and was not reviewed or endorsed by NFSA prior to submittal.

Cost Impact: The code change proposal will decrease the cost of construction

The allowance for sprinkler piping to penetrate townhouse separation walls will reduce the infrastructure required to install a fire sprinkler system in some cases by allowing a shared feed for multiple units.

RB67-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The plastic piping is a concern in a dry system. (Vote: 8-3)

Assembly Action:

None

RB67-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R302.2.2, R302.4.1, R302.4.2

Proponents:

Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R302.2.2 Common walls. Common walls separating *townhouses* shall be assigned a fire-resistance rating in accordance with Item 1 or 2. The common wall shared by two *townhouses* shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping, in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exceptions: 1.

1. Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:
 - ~~1.1~~ In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor.
 - ~~1.1.1~~ The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
 - ~~1.1.2~~ The area of the opening through the wall does not exceed 144 square inches (92 900 mm²).
 - ~~1.2~~ The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where stored (Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
2. The annular space created by the penetration of water-filled fire sprinkler piping, provided that the annular space is filled using a material conforming to Section R302.4.1.2.

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

1. Membrane penetrations of not more than 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m²) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m²) in any 100 square feet (9.29 m²) of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
 - 1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
 - 1.3. By solid fireblocking in accordance with Section R302.11.
 - 1.4. By protecting both boxes with *listed* putty pads.
 - 1.5. By other *listed* materials and methods.

2. Membrane penetrations by *listed* electrical boxes of any materials provided that the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the *listing*. The annular space between the wall membrane and the box shall not exceed $\frac{1}{8}$ inch (3.1 mm) unless *listed* otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 2.1. By the horizontal distance specified in the *listing* of the electrical boxes.
 - 2.2. By solid fireblocking in accordance with Section R302.11.
 - 2.3. By protecting both boxes with *listed* putty pads.
 - 2.4. By other *listed* materials and methods.
3. The annular space created by the penetration of a fire sprinkler or water-filled fire sprinkler piping, provided that ~~the~~ the annular space is covered by a metal escutcheon plate.
4. Ceiling membrane penetrations by *listed* luminaires or by luminaires protected with *listed* materials that have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the *listing*.

Commenter's Reason: The specific concern expressed by the committee has been addressed by this comment, which limits application of the proposed sprinkler penetration allowance to water-filled pipes. Although plastic pipe has been listed for dry residential sprinkler applications, use of those systems is not common enough to warrant arguing the point and missing this opportunity for progress with wet-pipe systems. The comment also adds a requirement to follow an already recognized/tested method (in the current exception) for protecting annular spaces surrounding through penetrations. With that increased level of protection, a fire could only pass the membrane by melting the pipe and causing water to leak, which would inherently protect the opening. Flame would be stopped at the barrier.

Additionally, water-filled sprinkler pipes will be allowed in common walls. This option provides for improved sprinkler designs for townhouses by allowing sidewall sprinklers to be deployed from common walls, which unlike exterior walls, are not exposed to freezing exterior conditions. By using sidewall sprinklers to protect the top floor instead of pendent sprinklers in the ceiling, sprinkler piping can be kept out of attics, which are subject to freezing.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The proposed change provides a design option that builders may or may not choose to use. If the option is selected, it would most likely be based on a decision by the builder that the builder's cost would be reduced.

RB72-19

IRC®: R302.9, R302.9.2, R302.9.3, R302.9.4, R302.9.1, R302.9 (New), R302.9.1 (New), R302.9.1.1 (New), R302.9.2 (New), R302.9.3 (New), R302.9.4 (New), R302.9.5 (New), R302.9.6 (New), R302.9.7 (New), R302.9.8 (New), R302.9.8.1 (New), R302.9.8.2 (New), R302.9.8.3 (New), R302.9.9 (New), ASTM Chapter 44 (New), NFPA Chapter 44 (New)

Proposed Change as Submitted

Proponents: Marcelo M Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Delete without substitution:

~~**R302.9 Flame spread index and smoke-developed index for wall and ceiling finishes.** Flame spread and smoke-developed indices for wall and ceiling finishes shall be in accordance with Sections R302.9.1 through R302.9.4.~~

~~**R302.9.1 Flame spread index.** Wall and ceiling finishes shall have a flame spread index of not greater than 200.~~

~~**Exception:** Flame spread index requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than $\frac{1}{20}$ inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.~~

~~**R302.9.2 Smoke-developed index.** Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.~~

~~**R302.9.3 Testing.** Tests shall be made in accordance with ASTM E84 or UL 723.~~

~~**R302.9.4 Alternative test method.** As an alternative to having a flame spread index of not greater than 200 and a smoke-developed index of not greater than 450 where tested in accordance with ASTM E84 or UL 723, wall and ceiling finishes shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:~~

~~The interior finish shall comply with the following:~~

- ~~1. During the 40 kW exposure, flames shall not spread to the ceiling.~~
- ~~2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.~~
- ~~3. Flashover, as defined in NFPA 286, shall not occur.~~
- ~~4. The peak heat release rate throughout the test shall not exceed 800 kW.~~
- ~~5. The total smoke released throughout the test shall not exceed 1,000 m².~~

Add new text as follows:

R302.9 Interior wall and ceiling finishes. Interior wall and ceiling finish materials shall be classified for fire performance and smoke development in accordance with Section R302.9.1 or R302.9.2, unless otherwise shown in Sections R302.9.3 through R302.9.9. Materials tested in accordance with Section R302.9.1 shall not be required to be tested in accordance with Section R302.9.2.

R302.9.1 NFPA 286. Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and comply with Section R302.9.1.1. Materials complying with Section R302.9.1.1 shall be considered to also comply with the requirements of Section R302.9.2.

R302.9.1.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m².

R302.9.2 ASTM E84 or UL 723. Wall and ceiling finishes shall exhibit a flame spread index not exceeding 200 and a smoke-developed index not exceeding 450 (Class C) where tested in accordance with ASTM E84 or UL 723, except as shown in Section R302.9.1 and in Sections R302.9.3 through R302.9.9.

R302.9.3 Interior trim. The requirements of Section R302.9.1 and those of Section R302.9.2, for interior wall and ceiling finishes, shall not apply to interior trim, defined as picture molds, chair rails, baseboards and handrails; or to doors and windows or their frames.

R302.9.4 Thickness exemption. The requirements of Section R302.9.1 and those of Section R302.9.2, for interior wall and ceiling finishes, shall not apply to materials having a thickness less than 0.036 inch (0.9 mm) and applied directly to the surface of walls or ceilings.

R302.9.5 High density polyethylene and polypropylene. Where high density polyethylene or polypropylene is used as an interior finish material, it shall be tested in accordance with NFPA 286 and comply with the requirements of Section R302.9.1.1.

R302.9.6 Facings or wood veneers intended to be applied on site over a wood substrate. Facings or veneers intended to be applied on site over a wood substrate shall comply with one of the following:

1. The facing or veneer shall meet the criteria of Section R302.9.1.1 where tested in accordance with NFPA 286 using the product mounting system, including adhesive, as described in Section 5.9 of NFPA 286.
2. The facing or veneer shall exhibit a Class C flame spread index and smoke-developed index where tested in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

R302.9.7 Laminated products factory-produced with a wood substrate. Laminated products factory-produced with a wood substrate shall comply with one of the following:

1. The laminated product shall meet the criteria of Section R309.2.1.1 where tested in accordance with NFPA 286 using the product-mounting system, including adhesive, as described in Section 5.8 of NFPA 286.
2. The laminated product shall have a Class C flame spread index and smoke-developed index where tested in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2579.

R302.9.8 Textile or expanded vinyl wall covering materials. Where textile wall covering materials or expanded vinyl wall covering materials are used as interior finish materials they shall be tested for fire performance in accordance with Sections R302.9.8.1, R302.9.8.2 or R302.9.8.3.

R302.9.8.1 Testing of textile or expanded vinyl wall covering materials to NFPA 286. Textile wall covering materials or expanded vinyl wall covering materials shall be tested in the manner intended for use in accordance with NFPA 286 using the product-mounting system, including adhesive, and comply with the requirements of Section R302.9.1.1.

R302.9.8.2 Testing of textile or expanded vinyl wall covering materials to ASTM E84 or UL 723. Textile wall covering materials or expanded vinyl wall covering materials shall exhibit a flame spread index not exceeding 200 and a smoke-developed index not exceeding 450 (Class C) where tested in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

R302.9.8.3 Testing of textile or expanded vinyl wall covering materials to NFPA 265. Textile wall covering materials and expanded vinyl wall covering materials shall be tested in the manner intended for use in accordance with the Method B protocol of NFPA 265 using the product-mounting system, including adhesive. The wall coverings shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 by 305 mm) walls.
3. Flashover, as defined in NFPA 265, shall not occur.
4. The total smoke released throughout the test shall not exceed 1,000 m².

R302.9.9 Textile or expanded vinyl ceiling covering materials. Textile ceiling covering materials or expanded vinyl ceiling covering materials shall be fire tested in accordance with ASTM E84 or UL 723, with the acceptance criteria of Section R302.9.2, or in accordance with NFPA 286, with the acceptance criteria of Section R302.9.1.1. Where tested in accordance with ASTM E84 or UL 723, specimen preparation and mounting shall be in accordance with ASTM E2404.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E2404: Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facings and Veneers, to Assess Surface Burning Characteristics (2017)

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E2579-15: Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy MA 02169-7471

265: Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls (2019)

Reason: This proposal reorganizes the section in the way that it is organized also in the IBC and IFC without changing requirements. Any material can be fire tested to NFPA 286 and those requirements are placed first, in R3029.1. With regard to the base requirement (testing for flame spread index and smoke-developed index by means of ASTM E84 or UL 723, with the corresponding criteria) it is still a Class C (flame spread index of 200 or less and smoke developed index of 450 or less) and it is all in a single section, namely R302.9.2. There is no change in the sense that, just like in the present code, materials can be tested to ASTM E84 or UL 723 (and get a Class C), or they can be tested to NFPA 286, with the requirements

presently in the code.

The following sections address requirements for materials that require special consideration.

Sections R302.9.3 and R302.9.4 address the exceptions: for trim and for very thin materials, adhered directly to the wall or ceiling. The requirement that the very thin material be tested contradicts the point that it is an exception and that it does not need testing. This requirement for testing the very thin material has been eliminated from the IBC and IFC also.

Section R302.9.5 addresses a key fire safety issue: high density polyethylene (HDPE) and polypropylene (PP) materials used as interior finish should not be tested using ASTM E84 because the test results are misleading. Such materials must be tested to NFPA 286, as shown in R302.9.1. This is a fire safety requirement also contained in the IBC and the IFC. The new section addresses the issue that it is not appropriate to allow testing of high density polyethylene (HDPE) and polypropylene (PP) materials used as interior finish in accordance with ASTM E84 or UL 723, because the test results are misleading. Such materials must be tested to NFPA 286, as shown in the new section R302.9.1.

What is needed is some testing requirement for thin materials used as veneers but adhered to wood products, either as manufactured panels brought into the building or as veneers applied on site. They are being addressed in R302.9.6 and R302.9.7. It has been shown that applying veneers over a wood product will have a significant effect (typically negative) on the fire performance of the product. A specific mounting practice for this has been developed both for ASTM E84 (namely ASTM E2404) and a specific section of NFPA 286 was developed for the purpose also. When a veneer is installed on site over a wood substrate, details are needed for fire testing the veneer. It needs to be tested over a substrate that is consistent with the substrate to be used in the application. If the veneer is to be applied over wood it should be tested over wood but if it is to be applied over gypsum board or a noncombustible substrate, it should be tested over that substrate. If the substrate is combustible testing over a wood substrate is an acceptable alternative. Section R302.9.7 addresses the case when manufacturers produce wood panels that have the veneer already applied before being introduced into the building. For that case, a specific mounting practice for ASTM E84 and a specific mounting method for NFPA 286 have been developed. In both cases the requirements involve testing the commercial panel and not the veneer. This language in both sections is consistent with language in the IBC and IRC, except that the requirements are for a Class C in ASTM E84, consistent with the charging paragraph.

Textile wall covering materials and expanded vinyl wall covering materials (Section R302.9.8) are permitted by the IBC and the IFC to be fire tested by three methods (they are the only type of product that have that option). They can be tested to ASTM E84 or UL 723, NFPA 286 and NFPA 265. If they are tested to ASTM E84 or UL 723 they need to use a special mounting method, namely ASTM E2404. Both the IBC and the IFC recognize a specific testing method that applies only to textile wall covering materials and expanded vinyl covering materials, namely NFPA 265. Therefore, commercial materials exist that have been tested to NFPA 265 and there is no reason that they should not be allowed into the IRC without further testing. The proposal contains the criteria from the IBC and IFC for testing to NFPA 265. This proposal does not require the materials to be tested to NFPA 265 or to NFPA 286 but allows materials already tested to NFPA 265 or to NFPA 286 to be used in the IRC. The NFPA 265 test is a room-corner test similar to NFPA 286, except for a few aspects: (a) the burner flame is less severe (150 kW instead of 160 kW), (b) the location of the burner is different (it is not placed flush against the corner) and (c) the material is not placed on the ceiling. Therefore the burner flame never reaches the ceiling, which makes the test unsuitable for ceiling materials.

Textile ceiling covering materials and expanded vinyl ceiling covering materials (Section R302.9.9) are permitted by the IBC and the IFC to be tested to NFPA 286 or to be tested to ASTM E84 or UL 723. However, when they are tested to ASTM E84 they need to use a special mounting method, namely ASTM E2404. They are not permitted to be tested to NFPA 265 because the flame in the test does not reach the ceiling.

Cost Impact: The code change proposal will increase the cost of construction

This proposal provides more testing options for some materials and clarifies the testing requirements that apply to some materials that should not be tested to ASTM E84.

Staff Analysis: The referenced standards, ASTM E 2579, ASTM E 2404 and NFPA 265, are currently referenced in other 2018 I-codes.

RB72-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This action is consistent with previous committee actions on proposals RB73, RB74, RB75 and RB76. This proposal combines those previous proposals and is much too complicated. A much simpler approach should be taken. (Vote: 9-2)

Assembly Action:

None

RB72-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R302.9 (New), R302.9.1 (New), R302.9.1.1 (New), R302.9.2 (New), R302.9.3 (New), R302.9, R302.9.1, R302.9.2, R302.9.3, R302.9.4

Proponents:

Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R302.9 Interior wall and ceiling finishes. Interior wall and ceiling finish materials shall be classified for fire performance and smoke development in accordance with either Section R302.9.1 or R302.9.2. Materials tested in accordance with Section R302.9.1 shall not be required to be tested in accordance with Section R302.9.2.

R302.9.1 NFPA 286. Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and comply with Section R302.9.1.1. Materials complying with Section R302.9.1.1 shall be considered to also comply with the requirements of Section R302.9.2.

R302.9.1.1 Acceptance criteria for NFPA 286. The interior finish material shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m².

R302.9.2 ASTM E84 or UL 723. Where wall and ceiling finish materials are tested in accordance with ASTM E84 or UL 723, they shall exhibit a flame spread index not exceeding 200 and a smoke-developed index not exceeding 450 (Class C).

R302.9.3 Exception. The requirements of Sections R302.9.1 and R302.9.2 shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than 1/28 inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.

~~R302.9 Flame spread index and smoke developed index for wall and ceiling finishes.~~ Flame spread and smoke developed indices for wall and ceiling finishes shall be in accordance with Sections ~~R302.9.1 through R302.9.4.~~

~~R302.9.1 Flame spread index.~~ Wall and ceiling finishes shall have a flame spread index of not greater than 200.

~~Exception:~~ Flame spread index requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than ¹/₂₈ inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.

~~R302.9.2 Smoke developed index.~~ Wall and ceiling finishes shall have a smoke developed index of not greater than 450.

~~R302.9.3 Testing.~~ Tests shall be made in accordance with ASTM E84 or UL 723.

~~R302.9.4 Alternative test method.~~ As an alternative to having a flame spread index of not greater than 200 and a smoke developed index of not greater than 450 where tested in accordance with ASTM E84 or UL 723, wall and ceiling finishes shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

The interior finish shall comply with the following:

- ~~1. During the 40 kW exposure, flames shall not spread to the ceiling.~~
- ~~2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.~~
- ~~3. Flashover, as defined in NFPA 286, shall not occur.~~
- ~~4. The peak heat release rate throughout the test shall not exceed 800 kW.~~

5. ~~The total smoke released throughout the test shall not exceed 1,000 m².~~

Commenter's Reason: This public comment replaces the original proposal in its entirety.

This public comment simplifies the original proposal by eliminating all the details of the testing and simply developing two sections: one for testing by NFPA 286 (base requirement) and one for testing by ASTM E84 or UL 723 (Class C). The exception is being retained as a new section clarifying that it applies to testing via NFPA 286 as well as to testing via ASTM E84 or UL 723. The added standards are being eliminated. This is consistent with the comments by the technical committee.

This is consistent with what is in the IBC and in the IFC but the code proposal does not change any of the requirements: it is still simply necessary to have a Class C in ASTM E84 or UL 723 (or be tested to NFPA 286) to be allowed as interior finish but it is clearer that materials that have already been tested to NFPA 286 and have met the corresponding requirements need not be tested again. This makes it explicit that it allows products that have already been tested to NFPA 286 to be used without additional testing.

In summary, this simplifies the code by noting that testing to ASTM E84 (or UL 723) is used for assessing flame spread index and smoke developed index and does it in one section and that NFPA 286 is an acceptable alternate. It also notes that the existing exception applies to both testing to ASTM E84 (or UL 723) and testing to NFPA 286, which is unclear in the code now.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change as a result of the public comment is editorial cleanup and clarification.

Public Comment# 1517

Public Comment 2:

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests Disapprove

Commenter's Reason: No data has been submitted to support the modification to making a very expensive test the primary test. NFPA is also known as the room corner test. NFPA 286 was added to the code to allow assemblies tested to the standard as meeting the intent of R302.9 and to prevent additional testing if the interior finish material used on the assembly was not also tested using E84. It was never intended to become the primary test.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The additional testing will increase cost of construction.

Public Comment# 1664

RB77-19

IRC®: R302.15 (New), R302.15.1 (New), R302.15.2 (New), R302.15.3 (New), R802.1.5, R802.1.5.1, R802.1.5.2, R802.1.5.3, R802.1.5.4, R802.1.5.5, R802.1.5.6, R802.1.5.7

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Add new text as follows:

R302.15 Fire retardant treated wood Fire-retardant treated wood (FRTW) is any wood product that: is impregnated with chemicals by a pressure process or other means during manufacture; that has a listed flame spread index of 25 or less when tested in accordance with ASTM E84 or UL 723, and that does not show evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

R302.15.1 Pressure process For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).

R302.15.2 Other means during manufacture For wood products produced by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product.

R302.15.3 Testing For wood products produced by means other than a pressure process during manufacture, all sides of the wood product shall be tested in accordance with and produce the results required in Section R302.15. For structural panels, only the front and back faces shall be required to be tested.

Revise as follows:

~~**R802.1.5 Fire-retardant-treated wood.** Fire-retardant-treated wood (FRTW) is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less and does not show evidence of significant progressive combustion where the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test. shall comply with Section R302.15.~~

Delete without substitution:

~~**R802.1.5.1 Pressure process.** For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).~~

~~**R802.1.5.2 Other means during manufacture.** For wood products produced by other means during manufacture the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product.~~

~~**R802.1.5.3 Testing.** For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5. Testing of only the front and back faces of wood structural panels shall be permitted.~~

Revise as follows:

~~**R802.1.5.4**~~ **R802.1.5.1 Labeling**. In addition to the labels required by Section 802.1.1 for sawn lumber and Section 803.2.1 for wood structural panels, each piece of *fire-retardant-treated* lumber and wood structural panel shall be labeled. The label shall contain:

1. The identification *mark* of an *approved agency* in accordance with Section 1703.5 of the International Building Code.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke-developed index.
6. Method of drying after treatment.
7. Conformance to applicable standards in accordance with Sections ~~R802.1.5.5~~ R802.1.5.2 through ~~R802.1.5.10~~ R802.1.5.7.
8. For FRTW exposed to weather, or a damp or wet location, the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D2898).

~~**R802.1.5.5**~~ **R802.1.5.2 Strength adjustments**. Design values for untreated lumber and wood structural panels as specified in Section R802.1 shall

be adjusted for fire-retardant-treated wood. Adjustments to design values shall be based on an *approved* method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

~~R802.1.5.6~~ **R802.1.5.3 Wood structural panels.** The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed by ASTM D5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

~~R802.1.5.7~~ **R802.1.5.4 Lumber.** For each species of wood treated, the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed by ASTM D5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80° F (27° C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

~~R802.1.5.8~~ **R802.1.5.5 Exposure to weather.** Where fire-retardant-treated wood is exposed to weather or damp or wet locations, it shall be identified as "Exterior" to indicate there is not an increase in the listed flame spread index as ~~defined~~ required by the testing specified in Section ~~R802.1.5~~ R302.15 when subjected to ASTM D2898.

~~R802.1.5.9~~ **R802.1.5.6 Interior applications.** Interior fire-retardant-treated wood shall have a moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section ~~R802.1.5.6~~ R802.1.5.3 or ~~R802.1.5.7~~ R802.1.5.4. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

~~R802.1.5.10~~ **R802.1.5.7 Moisture content.** Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and ~~plywood~~ the wood structural panels submitted for the tests described in Section ~~R802.1.5.6~~ R802.1.5.3 for ~~plywood~~ wood structural panels and ~~R802.1.5.7~~ R802.1.5.4 for lumber.

Reason: This proposal simply moves fire retardant treated wood (much of which is used indoors or for applications that do not involve roofing) away from the roofing section (jn Chapter 8) and places it in chapter 3 (section 302) where all the products with improved fire performance are. It does not make any change to requirements and uses the same code language but in a more appropriate chapter of the code. A pointer sends the user from the section the information used to be (in chapter 8) to the new location. Section R302 contains information on all the materials associated with "fire resistant construction", including wall and ceiling finishes, insulation and foam plastics. This is where the information on fire retardant treated wood belongs. Chapter 8 is on roof construction and, as staed above, many uses of fire retardant treated wood are for applications that are not roofs. The proposal keeps in chapter 8 the requirements for the wood products themselves, namely lumber and structural panels, to be consistent with cross-laminated timber and engineered rim wood board and so on. It just moves the requirements specific to fire retardant treated wood.

The changes in this proposal do not alter requirements but just move the sections for logical positioning. The only change in language is in relocated section R802.1.5.10 where the word plywood is replaced by wood structural panel, the title of relocated section R802.1.5.6, which is what is being referred to.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal simply relocates the FRTW sections from the roofing section to a new location, dealing with other fire safety issues, without changing requirements.

RB77-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: In Section R302.15, the terminology is switched. This proposal needs to be reformatted. The strength requirements need to move with the other requirements. We should stick with the original language if there is no intent to change technical requirements. (Vote: 11-0)

Assembly Action:

None

RB77-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R319, R319.2, R319.3, R319.4, R319.5, R319.6, R319.7, R319.8, R319.9, R319.10, R319.11, R803.2.1.2

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~R802.1.5~~ R319 Fire-retardant-treated wood.

R319.1 Fire-retardant-treated wood (FRTW) is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less and does not show evidence of significant progressive combustion where the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

~~R802.1.5.1~~ R319.2 **Pressure process.** For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).

~~R802.1.5.2~~ R319.3 **Other means during manufacture.** For wood products produced by other means during manufacture the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product.

~~R802.1.5.3~~ R319.4 **Testing.** For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5. Testing of only the front and back faces of wood structural panels shall be permitted.

~~R802.1.5.4~~ R319.5 **Labeling.** In addition to the labels required by Section 802.1.1 for sawn lumber and Section 803.2.1 for wood structural panels, each piece of *fire-retardant-treated* lumber and wood structural panel shall be labeled. The label shall contain:

1. The identification *mark* of an *approved agency* in accordance with Section 1703.5 of the International Building Code.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke-developed index.
6. Method of drying after treatment.
7. Conformance to applicable standards in accordance with Sections R802.1.5.5 through R802.1.5.10.
8. For FRTW exposed to weather, or a damp or wet location, the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D2898).

~~R802.1.5.5~~ R319.6 **Strength adjustments.** Design values for untreated lumber and wood structural panels as specified in Section R802.1 shall be adjusted for fire-retardant-treated wood. Adjustments to design values, including fastener values, shall be based on an *approved* method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

~~R802.1.5.6~~ R319.7 **Wood structural panels.** The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed by ASTM D5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

~~R802.1.5.7~~ R319.8 **Lumber.** For each species of wood treated, the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed by ASTM D5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80° F (27° C) and for roof framing. The roof framing modification factors shall take into consideration the climatological

location.

~~R802.1.5.8~~ **R319.9 Exposure to weather.** Where fire-retardant-treated wood is exposed to weather or damp or wet locations, it shall be identified as "Exterior" to indicate there is not an increase in the listed flame spread index as defined in Section R802.1.5 when subjected to ASTM D2898.

~~R802.1.5.9~~ **R319.10 Interior applications.** Interior fire-retardant-treated wood shall have a moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section R802.1.5.6 or R802.1.5.7. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

~~R802.1.5.10~~ **R319.11 Moisture content.** Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section R802.1.5.6 for plywood and R802.1.5.7 for lumber.

~~R803.2.1.2 Fire-retardant-treated plywood.~~ The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an *approved* method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an *approved agency*.

Commenter's Reason: FRTW may be used in more applications than just roofing the placement into R302.15 was deemed incorrect. Also, all of the relevant provisions were not brought over.

This is our attempt to clean up the proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Making the code more user friendly, no technical changes.

Public Comment# 1666

RB78-19

IRC@: R303.3

Proposed Change as Submitted

Proponents: Kevin Gore, Borough of West Chester, representing Borough of West Chester (kgore@west-chester.com)

2018 International Residential Code

Revise as follows:

R303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with ~~aggregate glazing area in windows of not less than 3 square feet (0.3 m²), one half of which shall be operable.~~ **Exception:** ~~The glazed areas shall not be required where~~ artificial light and a local exhaust

~~system are provided.~~

~~system.~~ The minimum local exhaust rates shall be determined in accordance with Section M1505. Exhaust air from the space shall be exhausted directly to the outdoors.

Reason: Typically, during winter and summer months or when inclement weather occurs, occupants fail to utilize windows in bathroom spaces to provide for proper ventilation to control moisture and humidity levels. The failure to utilize natural ventilation and the lack of mechanical ventilation in these spaces leads to mold and/or mildew conditions which can ultimately create unsanitary conditions and cause health problems for the occupants. According to the Centers for Disease Control and Prevention (2017), "In 2004 the Institute of Medicine (IOM) found there was sufficient evidence to link indoor exposure to mold with upper respiratory tract symptoms, cough, and wheeze in otherwise healthy people". Additionally, as we continue to improve the International Energy Conservation Code and enhance the energy efficiency of structures, we defeat the purpose of increased energy efficiency by requiring a window to be open in a space which is being heated or cooled.

Bibliography: Centers for Disease Control and Prevention. 2017. *Facts about mold and dampness*. Retrieved from https://www.cdc.gov/mold/dampness_facts.htm

Cost Impact: The code change proposal will increase the cost of construction. The cost to supply and install a mechanical exhaust fan is approximately \$300.00.

RB78-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: A fan is currently required only if a window does not provide the required amount of natural ventilation. Opening a window is a great way to provide ventilation. That option for satisfying the code should not be taken away. Even if a fan is available, that does not mean that occupants will use it. (Vote: 11-0)

Assembly Action:

None

RB78-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R303.3

Proponents:

Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov); Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with artificial light and a local exhaust system. The minimum local exhaust rates shall be determined in accordance with Section M1505. Exhaust air from the space shall be exhausted directly to the outdoors.

Exception: A local exhaust system shall not be required in spaces exempt from the building thermal envelope provisions of Section N1102 and that are provided with a window having an openable area of not less than 1.5 square feet (0.14 m²).

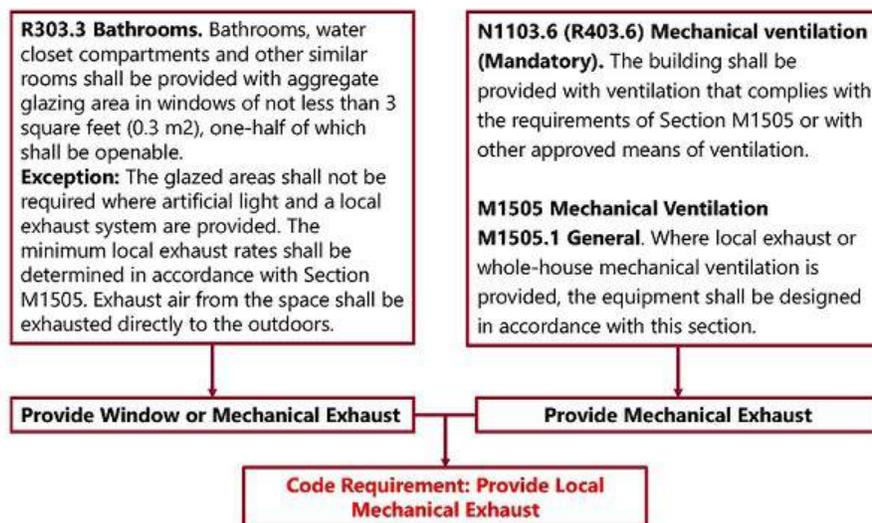
Commenter's Reason: Residential bathroom window openings first appeared as a code requirement in the 1946 Uniform Building Code (UBC). Besides window openings in the building perimeter walls, it was common practice for windows to also open into light and ventilation wells or shafts located within the building footprint. This served as a passive means to dissipate moisture, pollutants and odors. The effectiveness of these window openings depended on the atmospheric conditions of seasonal weather.

With the advent of exhaust fans during the fifties, the 1955 UBC added exhaust fans as an alternative means for removing moisture, pollutants and odors in lieu of window openings. Since then, the code language hasn't changed much despite mass adoption of bathroom exhaust fans in new home construction. During the 1980's and 90's, bathroom exhaust fans increasingly became the industry norm for removing moisture, pollutants and odors. Bathroom exhaust fans are no longer the exception but are now the rule, both in practice and by code requirement. Recognizing that tight building envelopes need mechanical ventilation to effectively manage moisture, IRC Section N1103.6 (R403.6) requires mechanical ventilation in accordance with Section M1505, which provides the minimum specifications for mechanical ventilation of bathrooms. For consistency, this code change aligns the requirements in N1103.6 with the language in R303.3 - recognizing that mechanical ventilation is required for any building that complies with the air sealing requirements of Section N1102, aligning the various sections of the code, and reclassifying openable windows as an exception rather than the rule. See the attached flow chart that illustrates how local mechanical exhaust in bathrooms is already required by the IRC.

In regards to natural light, the code change deletes the 3 sq. ft. window glazing (natural light) requirement and requires artificial light for bathrooms. Artificial lighting has been the industry standard since the electrification of homes over the past 80 to 90 years. Regardless of the amount of natural daylight provided, artificial light is still needed for nighttime use. Therefore an exception for artificial light is not needed in lieu of natural light.

This code change will improve the current language for consistency and clarity in the application and enforcement of this section.

R102.1: "Most Restrictive Shall Govern"



History of Bathroom Ventilation Requirements in the UBC (legacy code) and IBC

Compiled by Anthony Floyd, City of Scottsdale (7/14/19)

Code Year	Bathroom Window Size	Operable window required	Operable window size	Mech. Exhaust Fan
1927 UBC	Not specified	No	No	Not specified
1935 UBC	Not specified	No	No	Not specified
1937 UBC	Not specified	No	No	Not specified
1940 UBC	Not specified	No	No	Not specified
1943 UBC	Not specified	No	No	Not specified
1946 UBC	Not less than 3 sq. ft.	Yes	Not specified	Not specified
1949-UBC	Not less than 3 sq. ft.	Yes	Not specified	Not specified
1952 UBC	Not less than 3 sq. ft.	Yes	Not specified	Not specified
1955 UBC	Not less than 3 sq. ft.	Yes	Not specified	Exhaust fan in lieu of operable window
1958 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be operable	Exhaust fan in lieu of operable window
1961 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be operable	Exhaust fan in lieu of operable window
1964 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be operable	Exhaust fan in lieu of operable window
1967 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be operable	Exhaust fan in lieu of operable window
1970 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be operable	Exhaust fan in lieu of operable window
1973 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be operable	Exhaust fan in lieu of operable window
1976 UBC	Not specified.	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1979 UBC	Not specified.	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window

1982 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1985 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1988 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1991 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1994 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1997 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
2000 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2003 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2006 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2009 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2012 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2015 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2018 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window

Bibliography: Residential bathroom ventilation provisions of the following codes:

- Uniform Building Code (UBC) - 1927, 1935, 1937, 1940, 1943, 1946, 1949, 1952, 1955, 1958, 1961, 1964, 1967, 1970, 1973, 1976, 1979, 1982, 1985, 1991, 1994 and 1997 editions
- International Building Code (IBC) - 2000, 2003, 2006, 2009, 2012, 2015, 2018 editions

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change reorders the exception for clarity of existing code requirements. It does not require any additional compliance measures that are not already required in the code.

RB81-19

IRC@: SECTION R307, R307.1, R307.2, R307.3 (New), R307.3.1 (New), R307.3.2 (New), R307.3.3 (New), R307.3.4. (New), R307.3.5. (New)

Proposed Change as Submitted

Proponents: Jake Pauls, representing self (bldguse@aol.com)

2018 International Residential Code

Revise as follows:

SECTION R307 TOILET, BATH AND SHOWER SPACES, INCLUDING GRAB BAR PROVISION

R307.1 Space required. Fixtures shall be spaced in accordance with Figure R307.1, and in accordance with the requirements of Section P2705.1.

R307.2 Bathtub and shower spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet (1829 mm) above the floor.

Add new text as follows:

R307.3 Grab bars. Grab bars shall be in accordance with Sections R303.3.1 through R303.3.7.

R307.3.1 Grab Bar Provision. New bathtubs and showers shall be provided with grab bars complying with Section R307.3. Positioning of the grab bars, including stanchion type grab bars in addition to conventional wall mounted grab bars, shall be such that they are within reach of bathtub and shower users where such users are standing within the bathtub or shower and standing within the clearance spaces required by R307.2 as illustrated in Figure R307.1.

R307.3.2 Shower grab bar. A vertical grab bar shall be provided with a length of at least 24 inches (610 mm) positioned with its lower end not higher than 39 inches (990 mm) above the finished floor, its upper end not lower than 60 inches (1525 mm) above the finished floor, and located either inside or outside the shower enclosure and usable by a person entering and exiting the shower enclosure to occupy the clear floor area required by R307.2.

R307.3.3 Vertical bar for bathtub. A vertical grab bar with a minimum length of 36 inches (915 mm) shall be provided at the unobstructed entrance for the end wall of the bathtub, adjacent to the clear floor area required by R307.2 and positioned with its lower end not higher than 27 inches (685 mm) above the finished floor and its upper end not less than 60 inches (1525 mm) above the finished floor. If wall-mounted, the grab bar shall be between 9 inches (230 mm) and 12 inches (305 mm), measured horizontally, from the exterior plane of the bathtub. If provided as a stanchion extending from the ceiling to the floor or bathtub rim, the vertical bar shall be not more than 6 inches (150 mm) horizontally of the outer edge of the bathtub and not more than 30 inches (760 mm), measured horizontally, from the control end wall or from the water delivery spout in the absence of a control end wall.

R307.3.4. Horizontal or diagonal grab bar for bathtub. At the non-access side of the bathtub there shall be a diagonal or horizontal grab bar with a length of at least 24 inches (610 mm) placed not higher than 10 inches (255 mm) above the rim of the bathtub. If horizontally oriented the bar shall be positioned not higher than 10 inches above the rim of the bathtub and one end no more than 12 inches (305 mm), measured horizontally, from the control end or the water spout location if there is no control wall end. If diagonally oriented, the higher end shall be not more than 12 inches (305 mm) measured horizontally from the control end wall and between 25 inches and 27 inches (685 mm) above the rim of the bathtub.

R307.3.5. Grab bar details. Grab bars shall be circular in cross section with a minimum diameter of 1.25 inches (30mm) and a maximum diameter of 2 inches (50 mm). There shall be a clearance, for hand grasp, of not less than 1.5 inches (40 mm) between the bar and any surface. Grab bars shall be designed and constructed to withstand a load, in any direction, of 250 pounds minimum. Grab bars shall be designed and constructed with their fixings resistant to corrosion from water and to deterioration, from water, of surfaces and structure to which they are attached.

Reason: Reason Statement for IRC R307, new grab bar requirements in the IRC

General Introduction

Grab bars are what are, more generally, called "points of control" which help us maintain our posture and facilitate movement via our bodily contacts with surfaces underfoot and graspable fixed objects for our hands. For example, stair use requires—for minimum safety—one foot taking our body weight on a step (while the other foot moves between steps) and one hand on a handrail if we need lateral support of our upright bodies and/or some pulling assistance for the stair climb.

Thus, from a code point of view, it is widely accepted that stairs require at least one handrail to assure that at almost all times we have two points of control available when using stairs. The same ergonomic or biomechanical standard has not been generally applied to another dangerous act in buildings, entering and exiting a bathing or showering facility. In a home these facilities will typically require stepping over a bathtub wall or a low dam preventing water from draining onto the floor from a shower pan. This step-over behavior is complicated by the quality of the underfoot surfaces, some wet with water and others insecure due to other conditions (such as a dry towel or mat on a dry but very smooth tile surface) that are precursors to a slip. With this brief, fundamental consideration of the problem and its solution in mind, see Figure 1, a matrix which relates points of

control to simplified regulatory strategies, namely how many points of control are enough.

Right now, for bathing/showering on wet, slippery surfaces the point of control at our feet is very dubious and unreliable. And, currently, home bathrooms very, very seldom have any grab bars. The effective level of points of control in most home bathrooms is less than one. As already noted, stairs even in homes provide about two points of control (although, with undersized tread depths and dysfunctional decorative railings instead of function handrails, that figure of two might be closer to one). See Figure 1 for a hierarchy of points of control and situations where bathtubs/showers exist currently with very substandard availability of points of control combined with dangerous, hard surfaces to fall against and, thus, exacerbate injuries.

Grab Bar Equity with Stair Handrails

Number of Points of Control Via Hands or Feet	≤1	1	2	3	3-4
Standard walker for older adult with altered gait.					✓
Occupational settings with risk of worker falls from heights. Also, stairs where users can use two handrails simultaneously, one on each side.				✓	
Stairs where users have only a single handrail. <i>Grab bar(s) usable for bathtub/shower entry/egress.</i>			✓ ★		
Bathtubs/showers with slip resistant underfoot surfaces when wet.		✓			
Bathtubs/showers without slip resistant underfoot surfaces when wet, the common condition currently.	✓				

Figure 1. Hierarchy of Points of Control and Proposed Grab Bar Equity with Stair Handrails

Therefore, in recent years, there has been an international move to providing one or more new points of control for bathtubs and showers, largely to aid in two types of transfer for bathtubs—transfers in a standing position over the tub wall (for all tub uses) and transferring from a standing position to sitting or lying and later transferring from a lying or sitting position to standing. These bathtub transfers require two different points of control in relation to where the hand(s) are needed for the two types of transfers. Thus for all bathtub transfers two upper body points of control are needed either sequentially or simultaneously—the latter being increasingly important as one ages and loses lower body strength and has greater issues with balance generally. Especially as we get older, we rely more and more on bilateral support on stairs with handrails on both sides and bathtubs where there are points of control on both sides of the tub if we have a bath as opposed to showering.

The most basic package of grab bar requirements for transfers by ambulatory means is a single vertical grab bar reachable from the entrance area of a bathtub or a dedicated shower. If a bath is desired in a tub, then a diagonally oriented or horizontal bar on the non-access side of the tub is needed where there is often a wall on which to attach a conventional grab bar. An option is to use a horizontal stanchion (a bar or tube that is attached between surfaces rather than cantilevered from a surface) attached *between* end walls of a tub enclosure. See the installation photograph at the end of this Reason Statement; the horizontal stanchion is held in place by two large tiles through which the stanchion tube is passed with the tube ends butted against the wall tile with no hole made in the wall tile so there is no chance of water entry behind the wall tile due to this installation. High-grade adhesive is used to hold the assembly in place meeting the 250-pound load criterion easily.

The foregoing was the rationale used to develop the first set of mainstreamed grab bar requirements in a model building code as well as in a companion, safety standard—specifically NFPA 5000 and NFPA 101 in their 2018 editions and retained in the upcoming 2021 editions. The basic set of criteria that were adopted with very little fuss within the NFPA process has now been used to develop a proposal for the IRC, specifically Section R307 which deals with toilet, bath and shower spaces. This was where some people in ICC, during 2018 hearings for Group A code requirements, recommended a new mainstreamed grab bar requirement should be situated. Their advice has been followed in the proposal now submitted for Group B code requirements. (When the proponent started down this road of trying to get grab bar requirements into the I-codes, he was unaware there were various options on where such requirements might best fit. The consensus on this in last year’s Group hearings was “*not here*” and, for dwelling units, the logical place to be addressed in Group B was the Planning chapter of the IRC, specifically Section R307 on spaces in bathrooms. Hence, proposed here is the basic, minimum or entry level proposal to mainstreamed grab bars for dwelling units, the most likely context for injuries related to bathtubs and showers.

The Problem of Injuries Associated with Bathtubs and Showers

How Bathtub and Shower-related Injuries Compare to Other Injury Sources. Figure 1 provides a quickly appreciated comparison of the relative size of three problems in buildings: fires, stairs and baths/showers.

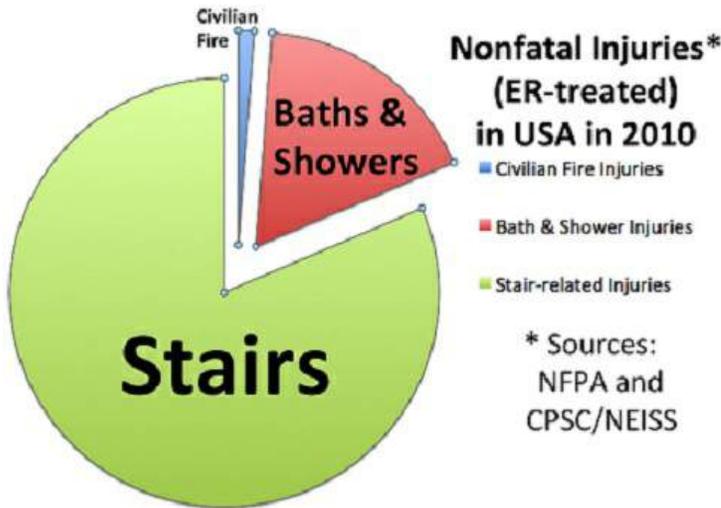


Figure 1. Chart of Approximate Relative Occurrence of Serious Injuries Associated with Three Common Dangers in Homes and Other Buildings

One can quickly see that injuries related to baths/showers greatly outnumber those from fire and that baths/showers are in the same league as stairs in terms of injuries. However, note that when exposure is taken into account, baths/showers are more dangerous. (Exposure will also be addressed in the following section where the other major safety culprit in home bathrooms is briefly noted.)

The central and most important point of this code change proposal is to respond to the relatively high risk of injurious falls when entering and exiting a bathing/showering facility. An organization, PIRE (Pacific Institute for Research and Evaluation), in Maryland is the best available source of some very insightful data collections that have been prepared by likely the finest minds on injury data in the world. PIRE has provided the proponent with data sets that have their origins in the US CPSC National Electronic Injury Surveillance System (NEISS) but have been subjected to intelligent analysis and presentation which are shared here, where they can do a lot of good.

First let us examine data on where (occupancy or building context) bathtub and shower injuries occur in the USA in the years 2010-2014. Table 1(a) provides this data set from PIRE along with a related data set, in 1(b) Table for toilets, the third relatively dangerous facility in home bathrooms.

Bathtubs & showers

Locale of accident	Frequency	Percent
0 Not recorded	209,935.6	21.02
1 Home	754,831.6	75.57
2 Farm/ranch	25.3	0.00
4 Street/highway	756.9	0.08
5 Other public property	29,838.6	2.99
6 Mobile/manuf home	75.2	0.01
8 School	1,092.9	0.11
9 Place of rec/sports	2,293.3	0.23
Total	998,849.3	100.00

Toilets

Locale of accident	Frequency	Percent
0 Not recorded	56,454.2	19.09
1 Home	203,471.0	68.79
4 Street/highway	165.6	0.06
5 Other public property	33,400.8	11.29
8 School	1,541.3	0.52
9 Place of rec/sports	760.4	0.26
Total	295,793.3	100.00

Tables 1(a) Bathtubs & Showers plus 1(b) Toilets: Injuries by Locale in the US

Some important preliminary lessons from these tables: first homes are, by far, the most common locale for bathroom-related injuries. People can avoid using showers anywhere, but they need to use toilets everywhere.

Next, let us examine data on rates of injuries by age group and the context of professional treatment for those injuries. Again we compare two tables addressing (a) bathing/showering and (b) toileting.

Bathtubs & showers			Hospital admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
00-09	92.0	107.1	5.3	1.1	204.0
10-19	84.6	54.7	1.3	0.5	241.2
20-29	159.5	81.7	3.1	1.3	245.4
30-39	223.7	90.4	1.7	1.3	308.9
40-49	302.5	88.0	5.5	1.7	397.2
50-59	383.8	87.6	8.8	3.3	469.3
60-69	222.1	77.4	25.6	5.2	320.3
70-79	284.3	105.9	33.3	10.4	433.8
>=80	429.0	201.0	90.4	24.7	745.1
Total	213.2	896.0	20.3	3.2	318.3

Toilets			Hospital admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
00-09	20.2	19.2	0.6	0.2	40.1
10-19	7.1	6.0	0.2	0.3	13.4
20-29	17.5	12.2	0.6	0.3	30.0
30-39	17.3	14.7	1.2	0.3	33.5
40-49	46.0	14.3	3.6	1.0	65.3
50-59	81.7	21.6	5.1	1.8	90.0
60-69	92.3	22.6	22.0	4.4	211.3
70-79	154.7	59.7	33.0	10.4	257.0
>=80	175.0	179.0	122.0	40.1	496.9
Total	575.0	233.0	8.7	2.4	593.3

**Tables 2(a) Bathtubs & Showers plus 2(b) Toilets:
Injury Rates by Age & Treatment Context**

Some important preliminary lessons from these tables: First, note the heightened vulnerability of older adults to injuries—at rates ten to a hundred times higher than for younger and middle-age adults. Second, note for the very oldest people, toilets are especially dangerous because their use—or avoidance of use—is not by choice as is the case for showers and baths. Third, note for the oldest people, injuries tend to be very serious as the rate for minor treatment is close to the rate for hospital admission.

Next, let us examine data on incidence (estimated number) of injuries by age group and the context of professional treatment for those injuries. Again we compare two tables addressing (a) bathing/showering and (b) toileting.

Bathtubs & showers			Hospital-admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
00-09	37,209.4	43,339.8	1,331.7	666.4	82,547.3
10-19	35,633.2	23,065.4	550.0	193.0	59,441.6
20-29	69,977.6	35,853.2	1,362.6	482.8	107,676.2
30-39	111,103.0	36,699.4	1,497.8	444.1	149,744.3
40-49	128,478.0	37,743.3	2,339.7	706.7	169,267.6
50-59	122,562.0	37,817.5	3,806.7	1,332.2	165,518.4
60-69	70,334.1	24,507.2	4,954.2	1,648.5	101,444.0
70-79	50,248.3	18,727.5	5,880.1	1,832.0	76,687.9
>=80	49,813.7	23,342.6	10,501.9	2,864.2	86,522.4
Total	675,359.0	281,096.0	32,224.6	10,169.9	998,849.5

Toilets			Hospital-admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
00-09	8,162.7	7,752.4	235.8	90.6	16,241.5
10-19	2,997.7	2,507.3	109.4	31.9	5,646.3
20-29	7,660.3	5,348.3	275.1	139.9	13,423.6
30-39	15,285.7	5,965.9	481.2	132.8	21,865.5
40-49	19,586.3	6,929.6	1,121.8	414.5	28,052.1
50-59	26,660.4	9,330.3	2,190.4	707.6	38,888.7
60-69	29,557.7	10,315.4	4,054.4	1,383.1	45,310.7
70-79	27,339.4	10,463.1	5,791.4	1,838.0	45,431.9
>=80	43,548.8	20,879.0	13,006.3	3,498.9	80,933.0
Total	180,799.0	79,491.3	27,265.8	8,237.2	295,793.3

**Tables 3(a) Bathtubs & Showers plus 3(b) Toilets:
Injury Incidence by Age & Treatment Context**

Some important preliminary lessons from these tables: Note that there are many injuries occurring to younger people so their greater preference for frequent bathing/showering is not reduced by the dangers; they still fall due to factors that go beyond frailty and/or balance issues that increase with older people. Their injuries might be less severe but they are still highly vulnerable to incidents with balance or footing, for example, from which they are less likely to be hurt very badly. In other words, there are problems to be addressed across the life span with bathing/showering.

The societal cost of these injuries was (for 2010) about 20 billion dollars for US bathtubs plus showers and about 93 billion dollars for US stairs with

the greatest risk for both being in homes, where bathing/showering is a near daily activity for most people in the US (Data source: Lawrence, B., Spicer, R., Miller, T. A fresh look at the costs of non-fatal consumer product injuries. *Injury Prevention*, digital publication, August 2014, paper journal publication, 2015:21:23-29.)

Source of the Text of the Proposed New Requirements for IRC Section R307.3

The source of the proposed new requirements is a few sources, first the proponent's proposals of last year for Group A changes to the IBC (first Means of Egress, Ch. 10 and later Interior Environment, Ch. 12) and the IRC (plumbing). A Comment was submitted only for the IBC knowing already that there were numerous suggestions that the best place in the IRC was not for a section in Group A; it was the Planning Chapter in Group B.

Other sources include activity in Canada on two separately submitted proposals, from 2007 and 2015, for mainstreamed grab bars, first only in homes and later in all occupancy contexts.

The best source was the proposals that have actually been incorporated in a major set of documents, NFPA 5000 and NFPA 101. The latter, in addition to adopting a package of requirements for mainstreamed grab bars in virtually every non-healthcare occupancy, adopted a new scoping provision (1.1.6): "Injuries from Falls. The Code also addresses reducing injury to occupants from falls." (NFPA 5000 already had such an expanded scope from its inception.) The proponent for both the successful mainstreamed grab requirements and the new scope statement was the current proponent of the two proposals to the I-Codes in Group A in 2018 and is the proponent of this proposal in Group B during 2019.

To be specific, for a few reasons the proponent elected to pattern the now-proposed requirements, for an expansion of IRC R307.3, on what NFPA has adopted and will soon include in its next code editions, the 2021 editions of NFPA 5000 and NFPA 101. This is not done out of loyalty to NFPA but, more fundamentally, because with all the discussions that have been going on internationally over the last two decades on improved bathroom safety, there is a consensus emerging on what a package of mainstreamed grab bar proposals should contain. So, bottom line, the ICC has a widely considered proposal in Group B for the IRC during 2019. They have had much discussion and, as noted in last year's proposals, the proponent is a devoted documenter of bathrooms in hotels in many countries due to, first, his attention to detail and, second, the need to document bathroom facilities to near-forensic standards for his 130 nights of travel using a variety of hotels, with rooms in a wide range of price categories, each year. Finally, the proponent practices what he preaches; see Figure 2 for the bathroom in his dwelling unit; it would readily comply with the proposed IRC requirements.



Figure 2. Bathroom Retrofitted (in a rental apartment) with Mainstreamed Grab Bar Set That Would Comply with the Proposed IRC Requirements for R307.3

Bibliography: An extensive bibliography of about 50 items was provided with all the Group A proposals on grab bars. That can be obtained from cdpAccess archives as well as from the proponent. There was only one citation to the literature in this Group B proposal and all the usual bibliographic information was included in the Reason Statement text.

Cost Impact: The code change proposal will increase the cost of construction

From careful analysis on related code change proposals in Canada (where an Impact Analysis is being required for many proposed changes to the National Building Code of Canada. The bottom line is that the payback period for the few hundred dollars of materials and labour to install two grab bars per shower-bathtub combination in a dwelling, even for two bathrooms in such a dwelling, is on the order of several years. After that, the grab bars just keep preventing and mitigating falls for decades, given the large cost of bathing/showering-related injuries as discussed in the Reason Statement.

RB81-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Reason: These requirements should be optional. The dimensions are not sufficient for all medical conditions. It might be more palatable if only the blocking had to be installed. (Vote: 11-0)

Assembly Action:

None

RB81-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R307.3 (New), R307.3.1 (New), R307.3.2 (New), R307.3.3 (New), R307.3.4. (New), R307.3.5. (New)

Proponents:

Jake Pauls, representing self (bldguse@aol.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R307.3 Grab bars. Grab bars shall be in accordance with Sections R307.3.1 through R307.3.7.

R307.3.1 Grab Bar Provision. New bathtubs and showers shall be provided with grab bars complying with Section R307.3. Positioning of the grab bars, including stanchion type grab bars in addition to conventional wall mounted grab bars, shall be such that they are within reach of bathtub and shower users where such users are standing within the bathtub or shower and standing within the clearance spaces required by R307.2 as illustrated in Figure R307.1.

R307.3.2 Shower grab bar. A vertical grab bar shall be provided with a length of at least ~~24~~36 inches (~~610~~915 mm) positioned with its lower end not higher than ~~39~~24 inches (~~990~~610 mm) above the finished floor, its upper end not lower than 60 inches (1525 mm) above the finished floor, and located either inside or outside the shower enclosure and usable by a person entering and exiting the shower enclosure to occupy the clear floor area required by R307.2.

R307.3.3 Vertical bar for bathtub. A vertical grab bar with a minimum length of 36 inches (915 mm) shall be provided at the unobstructed entrance for the end wall of the bathtub, adjacent to the clear floor area required by R307.2 and positioned with its lower end not higher than 27 inches (685 mm) above the finished floor and its upper end not less than 60 inches (1525 mm) above the finished floor. If wall-mounted, the grab bar shall be between 9 inches (230 mm) and 12 inches (305 mm), measured horizontally, from the exterior plane of the bathtub. If provided as a stanchion extending from the ceiling to the floor or bathtub rim, the vertical bar shall be not more than 6 inches (150 mm) horizontally of the outer edge of the bathtub and not more than 30 inches (760 mm), measured horizontally, from the control end wall or from the water delivery spout in the absence of a control end wall.

R307.3.4. Horizontal or diagonal grab bar for bathtub. At the non-access side of the bathtub there shall be a diagonal or horizontal grab bar with a length of at least 24 inches (610 mm) placed not higher than 10 inches (255 mm) above the rim of the bathtub. If horizontally oriented the bar shall be positioned not higher than 10 inches above the rim of the bathtub and one end no more than 12 inches (305 mm), measured horizontally, from the control end or the water spout location if there is no control wall end. If diagonally oriented, the higher end shall be not more than 12 inches (305 mm) measured horizontally from the control end wall and between 25 inches and 27 inches (685 mm) above the rim of the bathtub.

R307.3.5. Grab bar details. Grab bars shall be circular in cross section with a minimum diameter of 1.25 inches (30mm) and a maximum diameter of 2 inches (50 mm). There shall be a clearance, for hand grasp, of not less than 1.5 inches (40 mm) between the bar and any surface. Grab bars shall be designed and constructed to withstand a load, in any direction, of 250 pounds minimum. Grab bars shall be designed and constructed with their fixings resistant to corrosion from water and to deterioration, from water, of surfaces and structure to which they are attached.

Commenter's Reason: There has been an immense effort within Canada to develop a new generally applicable requirement for grab bars for all new bathtubs and showers in all occupancy settings. That proposed change to the National Building Code of Canada is going out for public review this autumn for incorporation in the NBCC 2020 edition. Over the last decade there has been a dedicated task group working on this change based on the weight of public health evidence, cost-benefit analysis, and careful consideration of how such a change fits in with international requirements (including NFPA 101 and NFPA 5000 requirements in their 2018 editions and continued incorporation in these codes' 2021 editions) and input from internationally active researchers on the subject of bathing safety for all ages.

The proposed NBCC provisions were originally based on NFPA requirements which also took account of ICC/ANSI A117.1 requirements for people

with disabilities so as to avoid incompatibilities among codes with mainstreamed requirements and standards specific to people with disabilities. This large international effort, based on the best available evidence, leads to some very minor tweaking of RB81-19.

Aside from correcting a few typos in R307.3, the technical change, in R307.3.1 and R307.3.3, is to the minimum vertical grab length, from 24 inches to 36 inches, and positioning of the lower end of the grab bar at a maximum height of 24 inches above the finished floor. This brings the ICC proposal into close alignment with the proposed 2020 Canadian requirements. Notably, bathtub and shower facilities in new Canadian homes are very similar to those in new US homes.

Turning to the ICC IRC-B Committee reasons for disapproving RB81-19, there are only three reasons given and two are completely unresponsive to the published evidence on the need for points of control for bathing and showering for which the risks of injury—*per unit of exposure (about once per day in the US)*—greatly exceeds that for stair-related injuries. Notably, all codes, including the IRC, require stairs to have handrails, the points of control that parallel those provided by grab bars and stanchions for bathtubs and showers. All ages are impacted by bathing/showering-related injuries, with the largest number being to young to middle-age adults. Thus the suggestion of the IRC-B Committee that grab bar “requirements should to optional” completely misses the point. Indeed, if the Committee were responsible for brakes on motor vehicles (or even bicycles), they would not have any brakes. Such vehicles never are sold to the consumers with the mere provision of incomplete braking systems, waiting for consumers to recognize that the installation is incomplete and a difficult and expensive retrofit is needed to make the vehicles fit for use in all conditions by all drivers.

The second of the three reasons given by the Committee, about “medical conditions” makes not sense whatsoever. Thus the disapproval decision by the IRC-B Committee should be overturned by ICC membership.

If ICC membership insists on maintaining the disapproval of RB81-19, it should be conditional on a move ICC leadership and ICC Chapters should pursue as quickly as possible. That is setting up a special study group/process for examining the epidemiological, economic, ergonomic and (generally) public health aspects—*in addition to construction feasibility*— of both bathtub/shower and stairway-related injuries which are currently leading to over five million professional treatments annually in the US. That is over four million such injuries for stairways and over one million injuries for bathtubs/showers. The societal cost of such injuries is well over one-hundred billion dollars per year in the US.

Reductions in such injury tolls, at least in new homes, are on the order of 60 percent for both stairways and bathtubs/showers. (See similar recommendations for a study group/process for stair-related proposals RB112-19 and RB118-19.)

If ICC continues to bungle along with very inferior requirements for the most dangerous aspects of homes—*their bathtubs/showers and their stairways*—it stands to lose immense credibility with the public. Both issues have been addressed in formally adopted policy positions of the American Public Health Association—*specifically in relation to improvements in NFPA and ICC codes and standards*—but only NFPA meets such APHA criteria for evidence-based usability and safety requirements. ICC has to move beyond its failure to utilize the available scientific and public health evidence for these two top-ranked injury sites in homes and other buildings. That will mean stopping ICC’s reliance on uninformed, personal and organizational input to its code-development process as witnessed in the public hearings on these matters generally, and on the three proposals (identified above) in Albuquerque.

Bathtubs & showers			Hospital admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
00-09	92.0	107.1	3.3	1.1	204.0
10-19	84.6	54.7	1.3	0.5	241.2
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10-19	7.1	6.0	0.2	0.3	13.4
20-29	17.5	12.2	0.6	0.3	30.0
30-39	37.3	14.7	1.2	0.3	53.5
40-49	66.0	16.3	1.6	1.0	85.9
50-59	81.7	21.6	5.1	1.8	90.0
60-69	93.3	22.6	21.0	4.4	211.3
70-79	154.7	59.7	33.0	10.4	257.0
>=80	276.0	179.0	132.0	40.1	696.9
Total	575.0	233.0	8.7	2.4	293.3

Tables 2(a) Bathtubs & Showers plus 2(b) Toilets:

Injury Rates by Age & Treatment Context

Bathtubs & showers			Hospital-admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
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20-29	69,977.6	35,853.2	1,362.6	482.8	107,676.2
30-39	111,103.0	36,699.4	1,497.8	444.1	149,744.3
40-49	128,478.0	37,743.3	2,339.7	706.7	169,267.6
50-59	122,562.0	37,817.5	3,806.7	1,332.2	165,518.4
60-69	70,334.1	24,507.2	4,954.2	1,648.5	101,444.0
70-79	50,248.3	18,727.5	5,880.1	1,832.0	76,687.9
>=80	49,813.7	23,342.6	10,501.9	2,864.2	86,522.4
Total	675,359.0	281,096.0	32,224.6	10,169.9	998,849.5

Toilets			Hospital-admitted		Total
Age	Doc/Outp	ED	via ED	Direct	
00-09	8,162.7	7,752.4	235.8	90.6	16,241.5
10-19	2,997.7	2,507.3	109.4	31.9	5,646.3
20-29	7,660.3	5,348.3	275.1	139.9	13,423.6
30-39	15,285.7	5,965.9	481.2	132.8	21,865.5
40-49	19,586.3	6,929.6	1,121.8	414.5	28,052.1
50-59	26,660.4	9,330.3	2,190.4	707.6	38,888.7
60-69	29,557.7	10,315.4	4,054.4	1,383.1	45,310.7
70-79	27,339.4	10,463.1	5,791.4	1,838.0	45,431.9
>=80	43,548.8	20,879.0	13,006.3	3,498.9	80,933.0
Total	180,799.0	79,491.3	27,265.8	8,237.2	295,793.3

Tables 3(a) Bathtubs & Showers plus 3(b) Toilets:

Injury Incidence by Age & Treatment Context

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. While there is some added original construction cost associated with provision of the proposed fall-related injury prevention and mitigation measures, the costs are more than balanced with savings in injury-related costs within one to ten years of use and the proposed new measures have useful service lives measured in several or more decades.

RB88-19

IRC@: R310.1

Proposed Change as Submitted

Proponents: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org); Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

Revise as follows:

R310.1 Emergency escape and rescue opening required. *Basements, habitable attics* and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Storm shelters and *basements* used only to house mechanical *equipment* not exceeding a total floor area of 200 square feet (18.58 m²).
2. Where the *dwelling* or *townhouse* is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 2.1. One means of egress complying with Section R311 and one emergency escape and rescue opening.
 - 2.2. Two means of egress complying with Section R311.
3. A *yard* shall not be required to open directly into a public way where an infill property is located next to adjoining neighboring properties without rescue openings that do not open directly into a public way.

Reason: The purpose of this code change is to address the condition where infill lots, and single lot new residential construction (i.e. townhomes/rowhouses), do not have the capacity for rescue openings to open directly into a public way. An infill project may not have the ability to comply with the rescue opening requirements by having access to a public way because the front yard may be non-existent, utility lines, steps and other constraints prevent placing an area well in the sidewalk, the side yards are non-existent due to party walls, and the rear yard may already be delineated without access to a public way due to the neighboring conditions, existing historic design of the neighborhood, or landlocked properties. This occurs in particular where fenced-in yards already exist for the neighboring properties. The problem is that since an infill project is considered new construction, compliance with zoning laws and ordinances, and for some projects historic design criteria, has led to denials of building permits. The code provisions have created a conflict between trying to maintain the architectural character of the neighborhood and meeting what the building code requires for new construction.

If a rear yard is required to open to a public way, and is next to adjoining existing neighboring properties with yards not opening to a public way, the code will affect the viability of the new infill project and where bedrooms can be located within the residence. With no public access in the rear yard or side yards, due to party walls or existing fences, all bedrooms will have to be located at the front of residence as that may be the only unobstructed path to a public way since sleeping areas require an emergency escape rescue opening. Basements may have to be left unfinished or used only for storage and utilities. This potentially reduces the market value of the new infill property relative to its neighbors since the adjoining properties do not have to follow the EERO requirements for new construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction since the new infill construction design intent is to match the neighboring existing properties also without rescue openings not opening directly into a public way.

RB88-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The concept is good, but it needs language clarifications. The purpose should not be to eliminate EEROs, but to allow an escape path for a new dwelling on an infill property. "Adjoining" and "neighboring" is redundant. This appears to be a way to circumvent code requirements just because one has neighbors. That should not be allowed. Life safety requirements should not be compromised just because it is difficult. Properties do not have rescue openings, buildings do. (Vote: 11-0)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IRC@: R310.1

Proponents:

Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R310.1 Emergency escape and rescue opening required. *Basements, habitable attics* and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Storm shelters and *basements* used only to house mechanical *equipment* not exceeding a total floor area of 200 square feet (18.58 m²).
2. Where the *dwelling* or *townhouse* is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 2.1. One means of egress complying with Section R311 and one emergency escape and rescue opening.
 - 2.2. Two means of egress complying with Section R311.
3. An emergency escape and rescue opening shall not be required to open directly into a public way or to a yard or court that opens to a public way where the building is located between existing buildings with yards or courts that do not open directly into a public way.

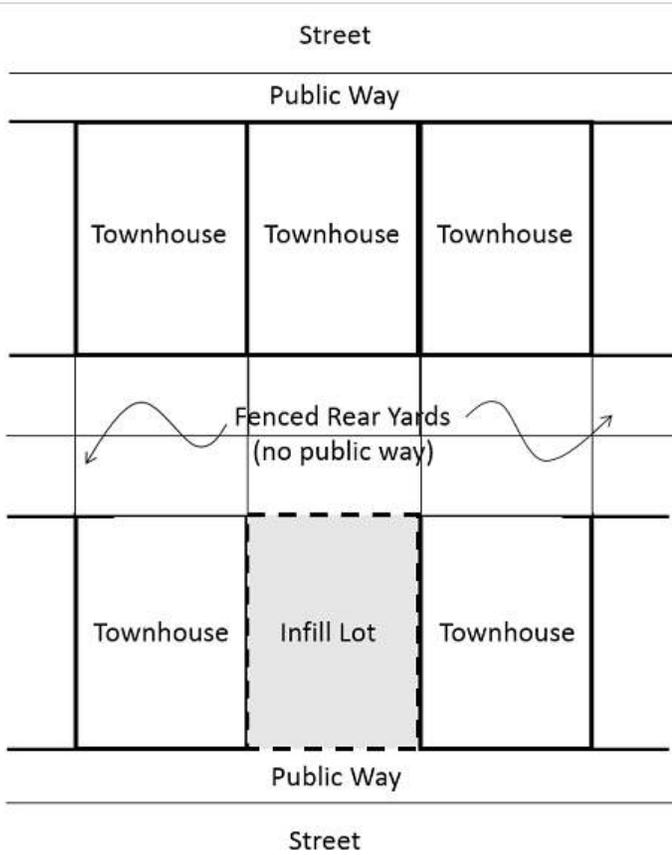
Commenter's Reason: The purpose of this code change is to address the condition where infill lots, and single lot new residential construction (i.e. townhomes/rowhouses), do not have the capacity for emergency escape rescue openings (EERO's) to open directly into a public way, as currently required. Affecting a small percentage of infill properties primarily located in older and historic neighborhoods, an infill project may not have the ability to comply with the EERO requirements by having access to a public way because the front yard may be non-existent and because utility lines, steps, and other constraints prevent placing an area well in the sidewalk.

Side yards are non-existent due to party walls, and the rear yard may already be delineated without access to a public way due to the neighboring conditions, existing historic design of the neighborhood, or landlocked properties. This occurs where fenced-in yards already exist for the neighboring properties, as detailed in the included graphic.

If a rear yard is required to open to a public way, and is next to adjoining existing neighboring properties with yards not opening to a public way, the code will affect the viability of the new infill project and where bedrooms can be located within the residence, because of EERO requirements. With no public access in the rear yard or side yards, due to party walls or existing fences, all bedrooms will have to be located at the front of residence as that may be the only unobstructed path to a public way since sleeping areas require an EERO.

Basements may have to be left unfinished or used only for storage and utilities. This potentially reduces the market value of the new infill property relative to its neighbors since the adjoining properties do not have to follow the EERO requirements for new construction.

The problem is that since an infill project is considered new construction, compliance with zoning ordinances, and for some projects, historic design criteria, has led to denials of building permits. The code provisions have created a conflict between trying to maintain the exterior historic architectural character of the neighborhood and meeting what the building code requires for new construction and EERO requirements.



Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change will not increase or decrease the cost of construction since the design intent is to address the emergency escape and rescue opening issues with new construction.

RB89-19

IRC: R301.1 (New), R310.1

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R310 EMERGENCY ESCAPE AND RESCUE OPENINGS

Add new text as follows:

R310.1 General. Emergency escape and rescue openings shall comply with the requirements of this section.

Revise as follows:

~~R310.1~~ R310.2 Emergency escape and rescue opening Where required. Basements, habitable attics and every sleeping room shall have ~~not~~ less not fewer than one operable emergency escape and rescue opening. ~~Where basements contain opening in accordance with this section.~~ Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. ~~Emergency escape and rescue~~ Such openings shall open directly into a public way, or to a yard or court that opens to a public way.

Exceptions:

1. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
2. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior egress balcony that opens to a public way.
- ~~1-3~~ Storm shelters and basements Basements used only to house mechanical equipment and not exceeding a total floor area of 200 square feet (18.58 m²) shall not be required to have emergency escape and rescue openings.
4. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
- ~~2-5~~ Where the dwelling or townhouse is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - ~~2-1-5.1~~ One means of egress complying with Section R311 and one emergency escape and rescue opening.
 - ~~2-2-5.2~~ Two means of egress complying with Section R311.

Reason: The intent of this proposal is to coordinate with the approved changes to INC (E107-18 AMPC1) and clarify the exceptions. Adding Section R310.1 is to coordinate with the format modification made by the public comment to E107-18.

There are revisions to the exceptions for where emergency escape and rescue openings are required. Exceptions 1 and 2 are current exceptions for EEROs in the IBC. New exception 1 is for basements with ceiling so low that they would not typically include normally occupied spaces. New exception 2 is to allow for the option of a door. The current exception 1 has been divided into new exceptions 3 and 4. New exception 3 clarifies that the 200 sq.ft. limit was for basements that only house mechanical equipment. The new exception 4 separates out storm shelters and adds a specific reference for ICC 500 (currently referenced in ICC R323). The current exception 2 is renumbered only.

This is one of a series of proposal to coordinate the requirements for emergency escape and rescue openings in the IBC and IRC. While independent issues, if all the proposals are approved, the IRC section would appear as indicated in the reason for the proposal to revise the definition – emergency escape and rescue openings.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is a coordination item for exceptions for EEROs already permitted between the codes.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The exterior egress balcony is not coordinated with the IRC. There should be a requirement that the exterior egress balcony be at least 36 inches wide. There should be a public comment to address Exception 2. Consider substituting "habitable" for "80 inches." (Vote: 7-4)

Assembly Action:

None

RB89-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R310.2 (New)

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R310.2 Where required. Basements, habitable attics and every sleeping room shall have not fewer than one emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way, or to a yard or court that opens to a public way.

Exceptions:

1. Basements ~~with a ceiling height of less than 80 inches (2032 mm) that do not contain habitable spaces~~ shall not be required to have emergency escape and rescue openings.
2. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, or court ~~or exterior egress balcony~~ that opens to a public way.
3. Basements used only to house mechanical equipment and not exceeding a total floor area of 200 square feet (18.58 m²) shall not be required to have emergency escape and rescue openings.
4. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
5. Where the dwelling or townhouse is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 5.1 One means of egress complying with Section R311 and one emergency escape and rescue opening.
 - 5.2 Two means of egress complying with Section R311.

Commenter's Reason: The modifications in this public comment are to address the committee reasons for disapproval.

Exception 1 –Section 305.2 set habitable areas in basements at 80" minimum ceiling height. So the exception as stated would be coordinated with 'habitable' and ceiling height.

Exception 2 – Exterior egress balconies are in the IBC, but not the IRC. Without criteria, this option will be deleted. This is a commercial multi-family option, not a single family option.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee->

bcac.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a coordination item for exceptions for EEROs already permitted between the codes.

Public Comment# 1251

RB90-19

IRC@: R310.1.1

Proposed Change as Submitted

Proponents: Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

2018 International Residential Code

Revise as follows:

R310.1.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices on windows serving as a required emergency escape and rescue opening shall be not more than 70" (177.8 cm) above the finished floor and shall comply with ASTM F2090.

Reason: The 70" (177.8 cm) is the sum of the dimensions in the attached example of a single hung egress window having a maximum 44" sill height with a 24" operable leaf. Added to this is 2" to reach the latch to unlock the window which is set at 70". Similarly on a casement window, the lock should also be no higher than 70" (177.8 cm) .

Unlike the dimensions for clear area, sill height, and minimum openings, a height has never been determined for the location of window controls for emergency and escape openings. This would make it very clear for all users of the code.

The 70" (177.8 cm) is the sum of the dimensions in the attached example of a single hung egress window having a maximum 44" sill height with a 24" operable leaf. Added to this is 2" to reach the latch to unlock the window which is set at 70". Similarly on a casement window, the lock should also be no higher than 70" (177.8 cm) .



Cost Impact: The code change proposal will not increase or decrease the cost of construction. This merely indicates the height of where the control should be. It would not add any cost to the manufacturing and installation.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The proponent made a good case for the addition of the dimensions and the limitation of the operation and control dimension height. (Vote: 9-2)

Assembly Action:

None

RB90-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests Disapprove

Commenter's Reason: Initially, while we do not believe such a requirement is necessary, we did not oppose it at the Committee Action Hearings. However, after further consideration we are seeking disapproval for that reason. In particular, because it establishes a requirement for the maximum height of window opening control devices (WOCD's) when they are required, but provides no direction for where on the device the measurement is to be taken. Typically, WOCD's vary in height from approximately 1.5" – 2.0." While in most common cases this may not be an issue because the entire WOCD is clearly located below 70," it will be problematic when any portion of the WOCD is at 70." In those cases, where is the measurement to be taken? At the top of the device, middle of the device, bottom of the device, some other location? If a maximum height requirement for required WOCD's is thought to be necessary, more clarity is needed for how it is to be applied. Given that clarity is not provided by this proposal and the need for the requirement is somewhat questionable, we are seeking disapproval.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This will decrease the cost of construction by alleviating an ambiguity as to where measurements for WOCD's are to be taken which could result in installed windows being needlessly rejected, or costly modifications to the installation that could also result.

Public Comment# 1820

RB93-19

IRC: R310.1.1

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

~~R310.1.1~~ **R310.2.1 Operational constraints and opening control devices.** Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening shall comply with ASTM F2090.

Reason: The term "special knowledge" was removed from IBC because the phrase "special knowledge" is too open for interpretations.

The revision to the last sentence could not require opening control devices or fall prevention devices. This section would just allow for them to be on windows that were also serving as emergency escape and rescue openings. ASTM F2090, *Specification for Window Fall Prevention Devices with Emergency Escape (Egress Release Mechanisms)*, includes criteria for window fall prevention devices and window opening control devices (see Section R312.2). This standard is specifically written for window openings within 75 feet (22 860 mm) of grade and specifically allows for windows to be used for emergency escape and rescue. This standard was updated in 2008 to address window opening control devices. This control device can be released from the inside to allow the window to be fully opened in order to comply with the emergency escape provisions in IRC.

This is one of a series of proposal to coordinate the requirements for emergency escape and rescue openings in the IBC and IRC. While independent issues, if all the proposals are approved, the IRC section would appear as indicated in the reason for the proposal to revise the definition – emergency escape and rescue openings.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a coordination item for emergency escape and rescue openings.

RB93-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This clarifies when it is appropriate to use these types of constraint devices on EEROs. (Vote: 10-1)

Assembly Action:

None

RB93-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R310.2.1 (New)

Proponents:

Stephen Thomas, representing Colorado Chapter (stthomas@coloradocode.net)

Modify as follows:

2018 International Residential Code

R310.2.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys ~~or~~, tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening .

Commenter's Reason: This proposal reinserts the language "special knowledge" back into the section. The proponent's reason statement stated, "The term "special knowledge" was removed from IBC because the phrase "special knowledge" is too open for interpretations". We disagree with this reason. This language has been used in many locations of the IBC and the IRC with no problem of interpretation. Code Officials are smart enough to understand the intent of this language. By removing this language, you open up the possibility of manufacturer's stating that their windows are in compliance with the code if you just remove the window sash. This doesn't require the use of any tool or key. You just have to find the little release mechanisms and pull the window sash out. Many single and double hung windows would meet this condition. This was proposed many years ago and rejected. These types of windows should not be permitted to be used as emergency and escape and rescue openings. They do not provide a quick and easy way of opening windows. The proponents reason also noted that this requirement was removed from the IBC. We feel that this was a mistake as well, but did not catch the change in the last cycle. The IRC is a separate and distinct code from the IBC. They do not need to be the same. The requirement for emergency escape and rescue openings are very limited in the IBC. They are required in all buildings in the IRC. There is more chances of a homeowner making revisions to an opening that would require special knowledge to open the window.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Since this would put the language back into the code as originally existed, there would be no change in the costs.

RB96-19

IRC@: R310.2.2

Proposed Change as Submitted

Proponents: Timothy Pate, Colorado Chapter Code Change Committee, representing City and County of Broomfield (tpate@broomfield.org)

2018 International Residential Code

Revise as follows:

R310.2.2 Window sill-opening height. Where a window is provided as the emergency escape and rescue opening, ~~it shall have a sill height of the bottom of the clear opening shall be~~ not more than 44 inches (1118 mm) above the floor; where the ~~sill height bottom of the clear opening is below grade,~~ it shall be provided with a window well in accordance with Section R310.2.3.

Reason: This proposal is to change the existing language back to what was changed in 2012. It was changed to the current language in 2015 (and stayed the same in 2018) with no apparent reason since it was a part of a larger change. This same language was changed for the 2012 (RB41-09/10) to measure to bottom of opening since it is confusing to what a sill is (no definition) and sills can be much lower than the bottom of opening especially with the heights of the window tracks on a lot of current vinyl windows. I am proposing to change this language back to what was in the 2012. This would also match the current language in IBC section 1030.3.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase or decrease the cost of construction. It will only clarify what the intent of the code is.

RB96-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee disapproved this proposal based on prior action on RB94 and per the proponent's request. (Vote: 11-0)

Assembly Action:

None

RB96-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Timothy Pate, representing Colorado Chapter Code Change Committee (tpate@broomfield.org)

requests As Submitted

Commenter's Reason: This public comment is to overturn the committee from a disapproval to approved as submitted in case RB94-19 which was approved is overturned and disapproved by membership. RB94-19 did the same as what my code change did but also did other good changes. If RB94 is not challenged I will withdraw this public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
this is just clarifying code intent

Public Comment# 1263

RB102-19

IRC@: R310.6

Proposed Change as Submitted

Proponents: Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (Jeffrey.Hinderliter@dos.ny.gov); Gerard Hathaway, New York State Department of State, representing New York State Department of State (gerard.hathaway@dos.ny.gov)

2018 International Residential Code

Revise as follows:

R310.6 Alterations or repairs of existing basements. An emergency escape and rescue opening is not required where existing *basements* undergo alterations or repairs.

Exception: New ~~sleeping rooms~~ habitable spaces created in an existing *basement* shall be provided with emergency escape and rescue openings in accordance with Section R310.1.

Reason: This exception emphasizes the importance of providing an emergency escape and rescue opening (EERO) when sleeping rooms are added to existing basements. However, when a basement is altered to create habitable space, such as a living room or recreational room, many of the same risks will be encountered in an emergency. In addition, when a basement is reconfigured to create multiple rooms, those rooms may not remain for non-sleeping purposes. For example, if a basement office is later converted to a bedroom, owners will rarely seek a permit. The intention of this code change is to increase the safety of basements when they are converted to habitable space and not just sleeping rooms. This code change would cause an owner to install an EERO when the alteration of a basement causes a basement to become habitable, which would include spaces used for living, sleeping, eating or cooking.

Cost Impact: The code change proposal will increase the cost of construction

This code change could increase the cost of construction due to EEROs being installed in habitable spaces rather than just sleeping rooms. If a basement was undergoing an alteration to create a habitable space other than a sleeping room, an EERO would now be required.

RB102-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The building codes should not address the "what if" scenarios. If the basement is finished later, then the EERO must be installed. If put in initially, the opening may be in the wrong location when the basement is finished. (Vote: 8-3)

Assembly Action:

None

RB102-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (jeffrey.hinderliter@dos.ny.gov); Felix Zemel, representing ICC Region 6 -- North East Regional Coalition (felix@pracademicsolutions.com); Gerard Hathaway, New York State Department of State, representing New York State Department of State (gerard.hathaway@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Submitted

Commenter's Reason: The Committee's published reason for disapproval is "*The building codes should not address the "what if" scenarios. If the basement is finished later, then the EERO must be installed. If put in initially, the opening may be in the wrong location when the basement is finished. (Vote: 8-3)*"

To address the committee's first comment on being a "what-if", this proposal is not addressing a "what if" scenario and EERO's are currently required in all new basements, whether they are habitable or not. The commentary to this section of code states in part "...the requirement for basements and habitable attics exists because they are so often used as sleeping rooms..."

As acknowledged by the IRC commentary, basements are frequently used as an extension of living space. This proposal simply requires those spaces converted to habitable spaces to provide the same level of egress as new construction.

To address the committee's second comment on EEROs being placed in the wrong location, this proposal does not tell you where it is to be placed. In creating the habitable space, the applicant will have the choice of where to best place the EERO to meet the code requirements. This is a similar situation to placing an EERO in a new basement that does not have habitable space.

Based on the original reason statement, the dissenting committee member's comments, and the information above addressing the committee's comments, the inclusion of EERO's in basements that are undergoing an alteration to create habitable space is a logical and consistent change to the IRC.

Bibliography: *2018 IRC Code and Commentary—Volume 1*. First Printing, Vol. 1 of 2, International Code Council, 2018.
2018 International Residential Code. First Printing, International Code Council, 2017.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated previously, this code change could increase the cost of construction due to EEROs being installed in habitable spaces rather than just sleeping rooms. If a basement was undergoing an alteration to create a habitable space other than a sleeping room, an EERO would now be required.

Public Comment# 1524

RB107-19

IRC@: [RB] 202, R311.7, R311.8

Proposed Change as Submitted

Proponents: Shaunna Mazingo, City of Westminster, representing Self (smozingo@cityofwestminster.us)

2018 International Residential Code

Revise as follows:

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another ~~within or attached to a building, porch or deck.~~

R311.7 Stairways. Where provided or required by this code, stairways shall comply with this section.

Exception: stairways not within or attached to a building, porch or deck

R311.8 Ramps. Where provided or required by this code, ramps shall comply with this section.

Exception: Ramps not within or attached to a building, porch or deck

Reason: Does a stair from a deck have to comply with any code requirements? That depends on who you talk to.

R311 talks about residential means of egress and requires one means of egress from a dwelling unit. With stairway provisions included under MOE in 311, does that mean that only stairs for the required egress have to comply and all others do not? 1/3 of those questioned believe this.

The definition of a stairway was changed to include some scoping to show that it includes levels attached to or within the building or porch or deck. Since the definition includes that wording, 1/3 of the people polled believe that all stairs that attach to the building or are within the building must comply.

R311.4 Vertical egress specifically mentions vertical egress being required from habitable spaces and doesnt mention decks and porches so the last third believe that the requirement is only for stairs of habitable spaces that must comply.

This proposal takes the scoping language out of the IRC definition so that the definition now matches the IBC definition and has added the scoping into the stairway and ramp sections so that the intent of the definition is actually realized in code language.

In CDP Access, R311.7 and 8 are put in as sections instead of subsections so it wouldnt let us edit as you can a subsection so we hope you get the idea that the intent is to read as follows:

R311.7 Stairways. When provided or required by this code, stairways shall comply with this section.

Exception: stairways not within or attached to a building, porch or deck

All remaining subsections of 311.7 unchanged. the same would work for ramps under r311.8.

We would also ask that the word "stairway" be italicized throughout R311 to clear up some of this. we were initially going to just suggest this as the fix but many agreed that the scoping wording in the IRC definition needed to come out and be placed in the body of the code.

Cost Impact: The code change proposal will increase the cost of construction

Some people will say it increases cost because stairs that were not from habitable space never had to comply. some will say that it will not increase cost because all stairs within or attached to the building had to always comply.

RB107-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R311.7 Stairways. Where ~~provided or~~ required by this code or provided, stairways shall comply with this section.

Exception: stairways not within or servicing ~~attached to~~ a building, porch or deck

R311.8 Ramps. Where ~~provided or~~ required by this code or provided, ramps shall comply with this section.

Exception: Ramps not within or servicing ~~attached to~~ a building, porch or deck

Committee Reason: This proposal clarifies the use of the code. The modification changes "servicing" to "attached to," which is more appropriate.
(Vote: 6-5)

Assembly Action:

None

RB107-19

Individual Consideration Agenda

Public Comment 1:

IRC@: [RB] 202, R311.7

Proponents:

Timothy Pate, representing City and County of Broomfield (tpate@broomfield.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another

R311.7 Stairways. Where required by this code or provided, stairways shall comply with this section.

Exception-Exceptions:

1. Stairways not within or servicing a building, porch or deck.
2. Stairways leading to non-habitable attics

Commenter's Reason: This public comment is to clarify that you would not need to have stairways to non habitable attics have to meet the main stairway requirements since you could actually have a fixed ladder of a pull down stair which do not meet any stair requirements and the area is classified as non habitable for living purposes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is just a clarification of existing code requirements

Public Comment# 1977

Public Comment 2:

IRC@: [RB] 202, R311.7

Proponents:

Timothy Pate, representing City and County of Broomfield (tpate@broomfield.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another

R311.7 Stairways. Where required by this code or provided, stairways shall comply with this section.

Exception- Exceptions:

1. Stairways not within or serving a building, porch or deck.
2. Stairways that lead to crawl spaces.

Commenter's Reason: This proposal is to add additional language to clarify that if you have a stairway to a crawl space it would not need to meet the stairway code requirements since you can also have ladders which do not meet any code requirements. Crawl spaces are not habitable spaces.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal is to clarify intent of existing code language

Public Comment# 1984

RB109-19

IRC@: R311.4

Proposed Change as Submitted

Proponents: Mike Fischer, Kellen Company, representing Self (mfischer@kellencompany.com)

2018 International Residential Code

R311.4 Vertical egress. Egress from habitable levels including habitable attics and *basements* that are not provided with an egress door in accordance with Section R311.2 shall be by a ramp in accordance with Section R311.8 or a stairway in accordance with Section R311.7. Stairways serving attics that do not contain habitable space are not required to meet the requirements of Section R311.7.

Reason: The IRC Contains some Means of Egress requirements, but does not address some constructions that fall outside of exit and egress. The code requires stairways to comply with a series of requirements for landings, stair tread and rise, handrails, headroom etc. Attics that are not habitable spaces and are thus unoccupiable should be exempt from stairway requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is consistent with current practice.

RB109-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal needs work. Having unregulated stairs is an issue. It would be preferred that some types of alternatives be proposed. Lesser requirements may be appropriate, but some level of safety should be specified. (Vote: 6-5)

Assembly Action:

None

RB109-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R311.4

Proponents:

Mike Fischer, representing Self (mfischer@kellencompany.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R311.4 Vertical egress. Egress from habitable levels including habitable attics and *basements* that are not provided with an egress door in accordance with Section R311.2 shall be served by a ramp in accordance with Section R311.8 or a stairway in accordance with Section R311.7. Stairways serving attics that do not contain habitable space are not required to meet the requirements of Section R311.7.

Commenter's Reason: This proposal is intended to be a clarification of the current IRC requirements for stairways. The proposal is modified by this public comment to insert a missing word "served" in R311.4; that is outside of the original proposal but is offered for the good of the order. I submitted this proposal because my brother built a detached garage in Chittenango NY, and wanted to utilize the space above the truss rafters for storage. I reviewed the code with the local code official, who approved the installation of stairs that allow access to the attic storage space but that do not meet the rise and run requirements for stairways serving means of egress in R311.7. In researching the issue, I discovered a gap in the code for these types of features that are not part of a means of egress.

Back to the proposal- which adds the following sentence: Why is this only a clarification and not a change?

Stairways serving attics that do not contain habitable space are not required to meet the requirements of Section R311.7.

Section R311 is titled MEANS OF EGRESS. That title is not defined in the IRC, but is found in the IBC. The IRC defaults to other codes for missing definitions:

R201.3 Terms defined in other codes. Where terms are not defined in this code such terms shall have the meanings ascribed in other code publications of the International Code Council.

The IBC definition of MEANS OF EGRESS:

[BE] MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a *public way*. A means of egress consists of three separate and distinct parts: the *exit access*, the *exit* and the *exit discharge*.

Additional Definitions for your consideration:

[RB] DWELLING. Any building that contains one or two *dwelling units* used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes

[RB] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered *habitable spaces*.

[BG] OCCUPIABLE SPACE. A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with *means of egress* and light and *ventilation* facilities meeting the requirements of this code.

Section R311 by definition can only apply to Means of Egress, and only from occupied portions of dwellings. While the IBC definition of Means of Egress is applied to buildings other than dwellings, the IRC limits MOE to serve occupied portions of dwellings. Note that the term "occupied" is not defined in the IRC, but "Occupiable Space" is defined in the IBC (see above.)

The IRC Means of Egress requirements are clear- IF you follow the trail of bread crumbs through the definitions. Here is the charging language:

R311.1 Means of egress. *Dwellings* shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the *dwelling* to the required egress door without requiring travel through a garage.

Note that Section R311.1 prohibits travel through a garage as part of the means of egress.

The proposal is specifically focusing on attics without habitable space. A finished attic in a garage cannot utilize a stairway through the garage as part of a means of egress per R311.7. The IRC stairway requirements only apply to means of egress; there is no required means of egress from non-habitable spaces- because of the IBC definition.

Some would say that homeowners will change an unfinished attic into habitable space in the future. If that occurs, it would be a violation of the code. The code should not be preempting the intent of future building occupants and assuming the worst-case scenario.

If we believe that stairs leading to non-habitable space should meet the means of egress requirements "just in case", then the code should require those same attic spaces to have windows to provide natural light and ventilation, an emergency escape and rescue opening (just in case the homeowner decides to add a sleeping room), AND an exterior landing and stairway to provide a code-compliant means of egress.

Please approve as modified by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The proposal will clean up an enforcement issue that often results in erroneous application of stairway requirements.

Public Comment# 2170

RB112-19

IRC@: R311.7.5.1, R311.7.5.2, R311.7.5.2.1

Proposed Change as Submitted

Proponents: Jake Pauls, representing self (bldguse@aol.com)

2018 International Residential Code

Revise as follows:

R311.7.5.1 Risers. The riser height shall be not more than ~~7 ³/₄ inches (196 mm)~~ 7 ³/₄ inches (180 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than ³/₈ inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open risers, openings located more than 30 inches (762 mm), as measured vertically, to the floor or grade below shall not permit the passage of a 4-inch-diameter (102 mm) sphere.

Exceptions:

1. The opening between adjacent treads is not limited on spiral stairways.
2. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than ~~10 inches (254 mm)~~ 11 inches (280 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ³/₈ inch (9.5 mm).

R311.7.5.2.1 Winder treads. Winder treads shall have a tread depth of not less than ~~10 inches (254 mm)~~ 11 inches (280 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a tread depth of not less than 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than ³/₈ inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within ³/₈ inch (9.5 mm) of the rectangular tread depth.

Exception: The tread depth at spiral stairways shall be in accordance with Section R311.7.10.1.

Reason: This proposal shares the Reason Statement for Proposal 5467, which includes the changes proposed on the step rise and tread depth — changing 7.75 inches for the maximum rise to 7 inches and changing the minimum tread depth from 10 inches to 11 inches in Sections R311.7.5.1, R311.7.5.2 and R311.7.5.2.1. Proposal 5467 accomplishes the same change indirectly by deleting almost all the requirements of R311.7 and requiring that stairs comply with NFPA 101-2018 which has the "7-11" requirement applying to dwelling unit stairs (with an exception for certain spiral stairs for which more options are provided in NFPA 101 than in the IRC). Those interested in this proposal should refer to the Reason Statement for Proposal 5467 dealing with all of R311.7. The bottom line is that if the "7-11" rule is applied (as it has for two decades for all other stairs in the IBC) and the dangers of injuries on stairways are mostly in homes, that is where the "7-11" should also be required. The Reason Statement provides very extensive technical and other information that directly confirms the much better performance of the "7-11" geometry relative to the several times more dangerous step dimensions — including the 7.75 - 10 geometry — that have been used in homes where about 90 percent of the stair-related falls occur in the US at a huge cost to everybody — currently on the order of \$100 billion dollars annually in societal injury costs in the USA.

Bibliography: A few publications are cited in the Reason Statement for my Proposal # 5467 and nothing beyond those is needed for this more-limited proposal.

Cost Impact: The code change proposal will increase the cost of construction

While cost of construction will increase, that increase (as shown also in the first proposal on this same topic in a 2003 proposal on stairways in the IRC) pales in comparison to the benefits of the "7-11" step geometry for dwelling unit stairs.

From the Reason Statement (which is the Reason Statement for Proposal 5467) covering all of R311, not just rise and tread depth changes, comes the following updated detail on cost impact in relation to step dimensions.

"If we assume, as an approximation, there were about 120 million US households in 2012 (the midpoint in the periods discussed above) and further assume an average of one flight of stairs for each household (with some homes having several flights of stairs and many having none), the average cost of home stairway-related injuries is roughly \$700 per stair flight (or household) per year. This average injury cost greatly exceeds the annual cost (e.g., over a 50-year service life) of a stair flight in a home. As currently allowed by the IRC and built into new homes, stairways with such high annual injury costs are an extremely poor investment in terms of costs to society, families

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This will limit homeowner and design options. The proponent did not provide information related to accidents that were specific to the code geometry that is now in the code. This should be looked at in more depth by ICC. (Vote: 10-1)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jake Pauls, representing self (bldguse@aol.com)

requests As Submitted

Commenter's Reason: The ICC IRC-B Committee provided only three reasons for disapproving RB112-19.

The first provided reason is largely without foundation as the additional space for providing a stair meeting the "7-11" standard is relatively small based on the current "7.75-10" standard which only the ICC codes permit (among US model codes). The area difference between the two standards is about the same as the area required for one 90-degree turn landing on a stairway which can, for example, be replaced with a set of tapered treads (e.g. four steps each turning 22.5 degrees) which make more-efficient use of space. Thus planning of the stairway generally allows more effective use of space which, overall for US homes has increased markedly over the last few decades with no comparable improvement in stairway safety and usability.

The second reason is addressed in the referenced shared justification for improved home stairs provided with companion proposal RB116-19. Specifically, there is about a 60 percent reduction (from 50 to 20 hospital emergency department treatments annually per 100,000 population) in injurious fall risk when the stair is improved from the "7.75-10" standard to "7-11" based solely on the one-inch increase in tread depth or run dimension as well as the 0.75-inch reduction in the permitted rise dimension. (See Table 3 of the RB116-19 proposal which is also addressed in a companion public comment to this one. RB116-19 dealt mostly with the improvements gained with the change to the NFPA 101-required "7-11" step dimension (minimum) for home stairs, adopted and maintained since 2003.

The third reason for Committee disapproval was not a reason but a strategy to address the future processing of such code change proposals on home stair step dimensions. I heartedly endorse the Committee's suggested strategy and would engage my talents and immense library and professional contact resources in making the effort successful.

I will even invest more than providing state-of-the-art advice to a study group or process within ICC. I would welcome any ICC chapter approaching me (at bldguse@aol.com) with a request to provide a custom presentation of a no-charge, half-day workshop to its members on not just the stairway safety issue but that of bathtub and shower safety (as addressed in my IRC proposal IRC81-19 and a public comment). Preferably that could be done prior to the Public Comment Hearings in Las Vegas but, if only possible later, that would be helpful in Chapter demonstration of real concern about these leading home-related injury topics that must be better addressed in ICC codes as well as in code enforcement procedures.

Along with the few people who provided complimentary viewpoints (privately or in public testimony) in Albuquerque on the stairway (and bathtub/shower) shower issues, I endorse having ICC move to the forefront in evidence-based code development, application and professional (as well as building trade) education and training. ICC member support for this comment in Las Vegas would be both appreciated and helpful in addressing a very large and ever-growing public health crisis from predictable and preventable injuries, especially from missteps and falls.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
See proposal RB112-19 for details.

Public Comment# 2113

RB114-19

IRC@: R311.7.8.4 (New)

Proposed Change as Submitted

Proponents: Lucas Pump, City of Cedar Rapids, representing Self (l.pump@cedar-rapids.org)

2018 International Residential Code

Revise as follows:

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.
3. Offsets or interruptions of six inches or less in total length shall be considered to be continuous.

Reason: This proposal would allow a handrail to terminate at a newel post or a wall section, then start back up. Also, this would allow for more aesthetically pleasing handrail designs, in a residential stairway were wall sections are off-set and would allow for a newel post within the handrail.



Cost Impact: The code change proposal will decrease the cost of construction

This proposal would decrease the cost of construction because the contractor could eliminate the need for some of the handrail offset fittings and elbows.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: No technical information has been brought forward for the proposal. The potential for multiple interruptions in this proposal is unsafe. The solution is to move the wall over and allow the wall to go up without interruptions. (Vote: 11-0)

Assembly Action:

None

RB114-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R311.7.8.4 (New)

Proponents:

Lucas Pump, representing Self (l.pump@cedar-rapids.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.
3. Offsets or interruptions of six inches or less in total length. Where the stair guard serves as a handrail that terminates at a wall and it initiates again within four inches, the handrail shall be considered to be continuous.

Commenter's Reason: I believe that this public comment fixes the concerns that were brought up during the Committee Action Hearings by adding the modification into the exceptions, instead of into the body of the code. Also, this solves a real world problem, as the "S" fitting does more harm than good and is not practical, as nobody drags there hand continually up the handrail around an "S" fitting, as a person walks up the stairs they pick up there hand and grab the handrail as they go. Another concern that was brought up was the fact that the original proposal didn't limit the amount of interruptions, and this makes it clear on the exact location in which you can interrupt it.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This code change would eliminate the need for the "S" fitting at the section where the guardrail ends, and handrail starts at a wall section.

Public Comment# 1151

RB115-19

IRC@: R311.7.8.4

Proposed Change as Submitted

Proponents: Stephen Thomas, Colorado Code Consulting, LLC, representing Himself (sthomas@coloradocode.net)

2018 International Residential Code

Revise as follows:

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts ~~or safety terminals.~~

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.

Reason: Ther term safety terminal is for commercial handrails that need to comply with the projecting elements requirements for the means of egress and accessibility. It is also not a defined term in the IRC. Many people don't know what a safety terminal is. Therefore, the language is not needed in the IRC and should be deleted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will have not an impact on the construction. It is deleting language that is not needed in the IRC.

RB115-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned toward a wall, guard or walking surface, or shall terminate in newel posts

Exceptions:

1. 1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. 2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

Committee Reason: This proposal provides more design options. The proposal does not work without the modifications. The modifications improve consistency between the IRC & IBC. (Vote: 11-0)

Assembly Action:

None

RB115-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R311.7.8.4

Proponents:

Emma Gonzalez-Laders, representing NYS Department of State (emma.gonzalez-laders@dos.ny.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned toward a wall, guard, or walking surface, or shall terminate ~~in a newel at a post.~~

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

Commenter's Reason: RB115-19 should be Approved As Modified by this public comment. The proposal as written is too restrictive by eliminating the possibility of terminating a handrail at a post or column. This modification would clearly permit posts and columns, as well as newel posts. This is supported by the first entry under the common definition of the word "post" found in the Merriam Webster online dictionary and here quoted: "*Post. Noun.*

1: a piece (as of timber or metal) fixed firmly in an upright position especially as a stay or support : PILLAR, COLUMN."

Bibliography: 1. "Post." Def.1. www.merriam-webster.com/dictionary/post. Merriam-Webster Dictionaries, (n.d.). Web. 24 July 2019.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is a clarification of the proposed code change.

Public Comment# 2002

Public Comment 2:

IRC@: R311.7.8.4

Proponents:

Thomas Zuzik Jr, of Railingcodes.com, Representing NOMMA – The National Ornamental and Miscellaneous Metals Association, representing NOMMA - The National Ornamental and Miscellaneous Metals Association (coderep@railingcodes.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned toward a wall, guard, or walking surface, continuous to itself or shall terminate ~~to a in newel posts.~~

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

Commenter's Reason: The proponent of RB115-19 both at the spring CAH and in their reason statement incorrectly stated "**the language is not needed in the IRC and should be deleted**"

A large majority of common metal handrail terminations currently fall under the term "Safety Terminal" from R311.7.8.4 within the code. By removing this terminology from the code it creates many conflicts with commonly used ornamental metal handrail terminations that were previously covered under the umbrella term "Safety Terminal".

The proponent of RB115-19 worked with others on the floor at the CAH and a modification was submitted to the original proposal and the committee approved RB115-19 as modified to exception 2, adding "and over the top landing" in an effort to encompass the same types of terminations that are

allowed over the bottom tread to be allowed over the top landing.

Even with the exception modification, the new language still falls very short and eliminates many previously allowed safe, safety terminations. This submitted public comment modification to the committee approved code proposal RB115-19 is presented to repair these over-sites before the code change becomes formal as explained in more detail here.

1. In the ornamental metal industry, there are two types of commonly used terminations that are noted as ending, but not ending. The first is best described as the racetrack handrail termination, this is commonly used down the center of stair flights where no guard is required or installed. You have a handrail on each side of a center post structure, and the handrail molding returns and is continuous to itself, both at the top and bottom landings establishing the safety terminal. (See Picture RCNOMMA-01.png)



2. The next commonly used ending non ending termination is a vertical continuous loop on each end of again a handrail molding set on posts and not a part of a guard. At each end, the handrail returns into a continuous loop establishing the safety terminal. (See Picture RCNOMMA-02.jpg)



3. The last modification is the removal of the word "newel" in conjunction with the term post. Many colonial type homes and other similar type homes commonly terminate into a full height column or full height trellis architectural type feature at the top and bottom of stair flights and this termination type was covered under the umbrella term "Safety Terminal". Under the new language which removes "safety terminal" from the code, a column or trellis is not listed and nor is it any of the currently listed "Wall, Guard, Walking Surface, Newel Post" or the new description noted above in this modification "Itself". Thus by removing "newel" from the language a column or the post in a trellis structure can be defined or referred to simply as a post and still encompass the termination that was previously allowed under the umbrella term "Safety Terminal" without adding to the laundry list. Where as per the new language the termination is deemed non-compliant or at best enters the guessing game of is it allowed or not based solely on if it is similar to a newel post in feature when it terminates? (See Pictures RCNOMMA-03 Column.jpg & RCNOMMA-04 Trellis.jpg)



For the reasons stated we request that you approve this modification by public comment to fix the original proponent's removal of compliant terminations, because his reason statement incorrectly states "will not change anything" but does drastically change many commonly used terminations from being compliant moving forward.

Bibliography: Pictures supplied by NOMMA Membership

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This proposed modification is centered on safe and compliant handrails terminations to continue to be used, where the current committee approved

code change cost statement is incorrect in stating there is no cost increase, when there is cost change. This public comment will return the cost effect to the original lower cost.

Public Comment 3:

Proponents:

Thomas Zuzik Jr, of Railingcodes.com, Representing NOMMA - The National Ornamental and Miscellaneous Metals Association, representing NOMMA - The National Ornamental and Miscellaneous Metals Association (coderep@railingcodes.com)

requests Disapprove

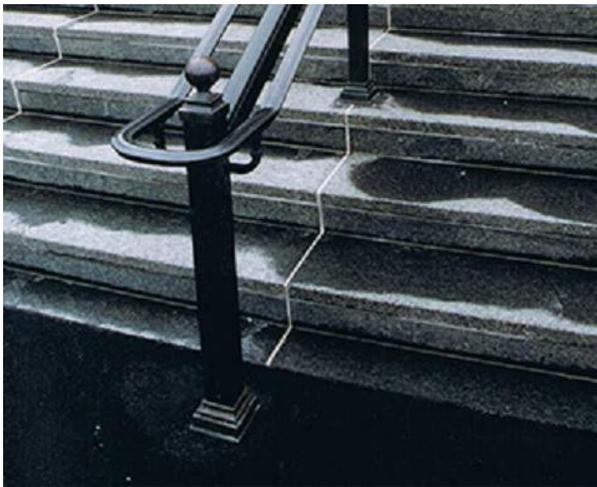
Commenter's Reason: The proponent of RB115-19 both at the spring CAH and in their reason statement, we believe, incorrectly stated **"the language is not needed in the IRC and should be deleted" and also incorrectly stated "will have no impact on the construction"**

A large majority of common metal handrail terminations currently fall under the term "Safety Terminal" from R311.7.8.4 within the code. By removing this terminology from the code it creates many conflicts with commonly used ornamental metal handrail terminations that were previously covered under the umbrella term "Safety Terminal".

The proponent of RB115-19 worked with others on the floor at the CAH and a modification was submitted to the original proposal and the committee approved RB115-19 as modified to exception 2, adding "and over the top landing" in an effort to encompass the same types of terminations that are allowed over the bottom tread to be allowed over the top landing.

However, even with modification to exception 2, the new language still falls extremely short and eliminates many previously allowed safe, safety terminations. The following information is presented for review to explain the conflicts the change in wording produces without adding additional information before removing the term "Safety Terminal" from the code.

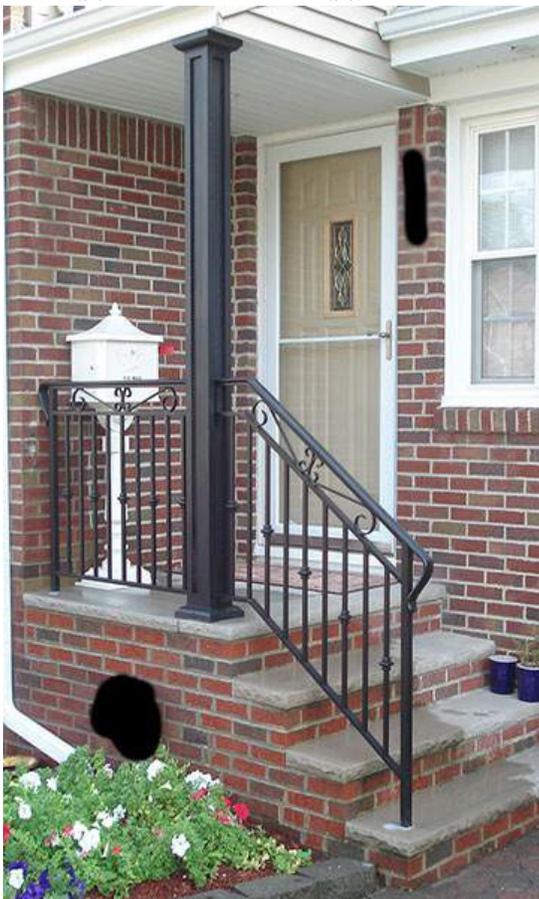
1. In the ornamental metal industry, there are two types of commonly used terminations that are noted as ending, but not ending. The first is best described as the racetrack handrail termination, this is commonly used down the center of stair flights where no guard is required or installed. You have a handrail on each side of a center post structure, and the handrail molding returns and is continuous to itself, both at the top and bottom landings establishing the safety terminal by continuing on to itself. (See Picture RCNOMMA-01.png)



2. The next commonly used ending non ending termination is a vertical continuous loop on each end of again a handrail molding set on posts which is not a part of a guard or guard system. At each end, the handrail returns into a continuous loop establishing the safety terminal on each end. (See Picture RCNOMMA-02.jpg)



3. Next it seems everyone always forgets that there are many types of architectural features that handrails terminate into that are not listed in the so called all inclusive list. Two of those terminations are into a column or trellis. These terminations are not into walls, guards or walking surfaces, and many times have been questioned and then commented on well does not the column or trellis return to the floor, hence compliant, however the simplest direction to compliance was it is a SAFE TERMINATION and therefore complies as a Safety Terminal. (See Pictures RCNOMMA-03 Column.jpg & RCNOMMA-04 Trellis.jpg)





4. However, the one termination that will get the most resistance will be the Vertical Volute. Many inspectors still argue with metal fabricators that a volute is just a horizontal wood scroll turnout over the bottom tread of a stair flight and not vertical. The metal handrail fabricators most widely used termination is a vertical volute as pictured below in the (4) examples. These handrail terminations are centuries old and the majority are formed to a specific die set, Makers Mark, of the fabricator themselves. Routinely approved by inspectors under the "Safety Terminal" provision of the code and not through exception 2. The vertical volute termination is one of the most economic and widely used metal safety terminals.







For the reasons stated we request dis-approval and NOMMA will reach out to work with the Proponent of RB115-19 to come to a more defined language for the next code cycle. As, we believe the proponent, has unintentionally incorrectly stated the proposal will not change anything, but does drastically change many commonly used terminations from being compliant moving forward.

Bibliography: Pictures by NOMMA Membership

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1719

RB116-19

IRC@: R311.7, R311.7.1, R311.7.2, R311.7.3, R311.7.4, R311.7.5, R311.7.5.1, R311.7.5.2, R311.7.5.2.1, R311.7.5.3, R311.7.6, R311.7.7, R311.7.8, R311.7.8.1, R311.7.8.2, R311.7.8.3, R311.7.8.4, R311.7.8.5, R311.7.10.1, R311.7.6.1, R311.7.6.2, R311.7.7.1, R311.7.7.2

Proposed Change as Submitted

Proponents: Jake Pauls, Jake Pauls Consulting Services, representing self (bldguse@aol.com)

2018 International Residential Code

R311.7 Stairways.

Revise as follows:

R311.7.1 Width. Stairways. Stairways shall be not less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. The clear width of stairways at and below the handrail height, including treads and landings, shall be not less than 34½ inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are installed on both sides. comply with NFPA 101-2018 Section 24.2.5.

Exception: The width of spiral stairways shall be in accordance with Section R311.7.10.1.

Delete without substitution:

R311.7.2 Headroom: The headroom in stairways shall be not less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

Exceptions:

1. Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall not project horizontally into the required headroom more than 4¾ inches (121 mm).
2. The headroom for spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.3 Vertical rise: A flight of stairs shall not have a vertical rise larger than 151 inches (3835 mm) between floor levels or landings.

R311.7.4 Walkline. The walkline across winder treads and landings shall be concentric to the turn and parallel to the direction of travel entering and exiting the turn. The walkline shall be located 12 inches (305 mm) from the inside of the turn. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface. Where winders are adjacent within a flight, the point of the widest clear stair width of the adjacent winders shall be used.

R311.7.5 Stair treads and risers: Stair treads and risers shall meet the requirements of this section. For the purposes of this section, dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

R311.7.5.1 Risers: The riser height shall be not more than 7¾ inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than ¾ inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open risers, openings located more than 30 inches (762 mm), as measured vertically, to the floor or grade below shall not permit the passage of a 4-inch diameter (102 mm) sphere.

Exceptions:

1. The opening between adjacent treads is not limited on spiral stairways.
2. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ¾ inch (9.5 mm).

R311.7.5.2.1 Winder treads: Winder treads shall have a tread depth of not less than 10 inches (254 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a tread depth of not less than 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than ¾ inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within ¾ inch (9.5 mm) of the rectangular tread depth.

Exception: The tread depth at spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.3 Nosings: Nosings at treads, landings and floors of stairways shall have a radius of curvature at the nosing not greater than ¾ inch (14

mm) or a bevel not greater than $\frac{1}{2}$ inch (12.7 mm). A nosing projection not less than $\frac{3}{4}$ inch (19 mm) and not more than $1\frac{1}{4}$ inches (32 mm) shall be provided on stairways. The greatest nosing projection shall not exceed the smallest nosing projection by more than $\frac{3}{8}$ inch (9.5 mm) within a stairway.

Exception: A nosing projection is not required where the tread depth is not less than 11 inches (279 mm).

Revise as follows:

R311.7.5.4 R311.7.2 Exterior plastic composite stair treads. Plastic composite exterior stair treads shall comply with the provisions of this section and Section R507.2.2.

Delete without substitution:

R311.7.6 Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway. The width perpendicular to the direction of travel shall be not less than the width of the flight served. For landings of shapes other than square or rectangular, the depth at the walk line and the total area shall be not less than that of a quarter circle with a radius equal to the required landing width. Where the stairway has a straight run, the depth in the direction of travel shall be not less than 36 inches (914 mm).

Exception: A floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided that a door does not swing over the stairs.

R311.7.7 Stairway walking surface. The walking surface of treads and landings of stairways shall be sloped not steeper than one unit vertical in 48 inches horizontal (2-percent slope).

R311.7.8 Handrails. Handrails shall be provided on not less than one side of each flight of stairs with four or more risers.

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. Where handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to *guard*, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed 38 inches (956 mm).

R311.7.8.2 Handrail projection. Handrails shall not project more than $4\frac{1}{2}$ inches (114 mm) on either side of the stairway.

Exception: Where nosings of landings, floors or passing flights project into the stairway reducing the clearance at passing handrails, handrails shall project not more than $6\frac{1}{2}$ inches (165 mm) into the stairway, provided that the stair width and handrail clearance are not reduced to less than that required.

R311.7.8.3 Handrail clearance. Handrails adjacent to a wall shall have a space of not less than $1\frac{1}{2}$ inches (38 mm) between the wall and the handrails.

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.

R311.7.8.5 Grip size. Required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of not less than $1\frac{1}{4}$ inches (32 mm) and not greater than 2 inches (51 mm). If the handrail is not circular, it shall have a perimeter of not less than 4 inches (102 mm) and not greater than $6\frac{1}{4}$ inches (160 mm) and a cross section of not more than $2\frac{1}{4}$ inches (57 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).
2. Type II. Handrails with a perimeter greater than $6\frac{1}{4}$ inches (160 mm) shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within $\frac{3}{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and have a depth of not less than $\frac{5}{16}$ inch (8 mm) within $\frac{7}{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $\frac{3}{8}$ inch (10 mm) to a level that is not less than $1\frac{3}{4}$ inches (45 mm) below the tallest portion of the profile. The width of the handrail above the recess shall be not less than $1\frac{1}{4}$ inches (32 mm) and not more than $2\frac{3}{4}$ inches (70 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).

Revise as follows:

R311.7.8.6 R311.7.3 Exterior plastic composite handrails. Plastic composite exterior handrails shall comply with the requirements of Section

R507.2.2.

~~R311.7.9~~ **R311.7.4 Illumination.** Stairways shall be provided with illumination in accordance with Sections R303.7 and R303.8. The illumination system shall be capable of providing a minimum of 10 foot-candles (110 lux), measured at the center of stairway landings and treads, when the stairway is in use.

~~R311.7.10~~ **R311.7.5 Special stairways.** ~~Spiral stairways and bulkhead~~ Bulkhead enclosure stairways shall comply with the requirements of Section R311.7 except as specified in Sections R311.7.10.1 and R311.7.10.2. NFPA 101-2018 Section 24.2.2.3.

Delete without substitution:

~~R311.7.10.1~~ **Spiral stairways.** The clear width at and below the handrails at spiral stairways shall be not less than 26 inches (660 mm) and the walkline radius shall be not greater than 24¹/₂ inches (622 mm). Each tread shall have a depth of not less than 6³/₄ inches (171 mm) at the walkline. Treads shall be identical, and the rise shall be not more than 9¹/₂ inches (241 mm). Headroom shall be not less than 6 feet 6 inches (1982 mm).

~~R311.7.10.2~~ **Bulkhead enclosure stairways.** Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of Sections R311.3 and R311.7 where the height from the basement finished floor level to grade adjacent to the stairway is not more than 8 feet (2438 mm) and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

Revise as follows:

~~R311.7.11~~ **R311.7.6 Alternating tread devices.** Alternating tread devices shall not be used as an element of a means of egress. Alternating tread devices shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches (508 mm).

Exception: Alternating tread devices are allowed to be used as an element of a means of egress for lofts, mezzanines and similar areas of 200 gross square feet (18.6 m²) or less where such devices do not provide exclusive access to a kitchen or bathroom.

~~R311.7.11.1~~ **R311.7.6.1 Treads of alternating tread devices.** Alternating tread devices shall have a tread depth of not less than 5 inches (127 mm), a projected tread depth of not less than 8¹/₂ inches (216 mm), a tread width of not less than 7 inches (178 mm) and a riser height of not more than 9¹/₂ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

~~R311.7.11.2~~ **R311.7.6.2 Handrails of alternating tread devices.** Handrails shall be provided on both sides of alternating tread devices and shall comply with Sections R311.7.8.2 to R311.7.8.6. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

~~R311.7.12~~ **R311.7.7 Ships ladders.** Ships ladders shall not be used as an element of a means of egress. Ships ladders shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches.

Exception: Ships ladders are allowed to be used as an element of a means of egress for lofts, mezzanines and similar areas of 200 gross square feet (18.6 m²) or less that do not provide exclusive access to a kitchen or bathroom.

~~R311.7.12.1~~ **R311.7.7.1 Treads of ships ladders.** Treads shall have a depth of not less than 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the nosing projection is not less than 8¹/₂ inches (216 mm). The riser height shall be not more than 9¹/₂ inches (241 mm).

~~R311.7.12.2~~ **R311.7.7.2 Handrails of ships ladders.** Handrails shall be provided on both sides of ships ladders and shall comply with Sections R311.7.8.2 to R311.7.8.6. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm). Section R311.7.1.

Reason: Introduction. Over the last two decades, covering the entire history of the *International Residential Code*, subsection R311.7 on stairways—which started with some serious defects—has not improved as much as warranted by the home stair-related injury toll, especially the toll's growth over the last two decades. This proponent sees little value in addressing, *in detail*, all of the IRC's deficits with regards to stairways unless there are major changes in how ICC members and committees understand and address the overarching topic of home step dimensions, handrail requirements, etc., with step dimensions being the most potent set of factors impacting both home stairway usability and safety. Thus the best strategy is to propose a substitution of most of the IRC's stairway requirements with a reference to NFPA 101's Chapter on One and Two-Family Dwellings.

The justification for this drastic proposal is technical as well as procedural, with emphasis below on the technical issues. Addressing the procedural issues would mean going into detail on the overarching role of two organizations in the development, to date, of the IRC's stairway requirements, namely the National Association of Home Builders (NAHB) and the Stairway Manufacturers Association (SMA).

Neither of these organizations have been participating actively in all the research conducted over the last five decades in several countries, most notable of which are the USA, the UK, Japan and Canada. Such participation clearly sets the proponent of this substitution apart from the NAHB and

SMA, both organizationally and in terms of any individual in these organizations (now and in the past three decades).

The proponent's participation entails formal research (for 20 years at the National Research Council of Canada), international consulting (for four decades), ergonomics certification (since 1993, with re-certifications in 2010 and 2015), and public health involvement (as the lead, formal/voting representative for the American Public Health Association, APHA, on eight ICC and NFPA committees dating back two decades). His publications record includes about 100 publications on stairway use, safety and design. His record of formal presentations worldwide includes over 100 on stairways beginning in 1974. His record production of educational and documentary videos include over 30 videos and one documentary film, "The Stair Event" (the only such film on stairways, produced 40 years ago).

No individual, organization or any collection of these, can match the proponent's record of scientific and technical accomplishments since 1967 which has resulted in several awards and an Honorary Doctor of Science degree. These reflect international recognition focused most intensively in three countries, the USA (his longest base of activity), Canada and the UK.

Moreover, the proponent is relatively well known by premises liability attorneys in the US and Canada who represent persons injured on stairways or, in a minority of cases, attorneys representing premises owners and operators. Some of the latter, rather than being defendants, are corporate counsel for very large organizations with multiple facilities where stairway safety has been a major concern and the organization wishes to take a pro-active approach to injury prevention. In Canada, due to the premises liability laws there, the proponent's litigation-related work focuses much more on one- and two-family dwellings than is the case in the USA where the home stairway dangers are almost as bad as in Canada—especially in relation to stair step dimensions, but there has been less litigation focused on the comparable dangers to stairway users.

Bottom line: much has been learned over the last four decades especially that draws on multiple sources of insight on the real dangers of stairways and the need for model code organizations, adopting authorities and enforcing officials to recognize just how devastating the home stairway-related injury **endemic** has become. Only NFPA has responded realistically to the home stairway-related endemic. ICC has had the opportunity to do so over the last 20 years but it has failed, very badly, to respond to the public health and safety situation. ***This has to change!***

Analogy connecting stairways and automobiles. For readers who are put off by technical and other details, please read the following sentences about an apt comparison. Imagine the outcry that would have occurred if, starting decades ago, the automobile industry adopted, and implemented, a policy of only providing brakes for vehicles that were only used by relatively fit, working-age adults. For everyone else—e.g., children and older adults—vehicles would not be provided with functional brakes or steering that worked reliably for people with widely varying strength abilities. Of course the automobile industry—internationally (partly following developments in the USA)—took a different path, a path to cars that were not only safer, for example with brakes and steering systems, but were much more functional. These and other systems served a wide range of drivers and occupants in ALL use conditions, not only crashes, emergency stopping and control but for normal operational usability.

Through the decades, while the automobile industry adopted more progressive policies—*partly dictated by laws and regulations*—the building industry has steadfastly avoided clear evidence that home stairway-related falls were growing faster than population growth and costs of stair-related injuries vastly exceeded the initial costs of stairway construction. Indeed the building industry operated oblivious of scientific knowledge and other evidence.

APHA Policies on Building Codes. Since the turn of the century, ICC has diverged from NFPA's far more evidence-based approach to ALL stairways, notably those in homes, as well as repeated public policies adopted by the American Public Health Association (APHA).

- APHA Policy Statement 99-16, Public Health Role of Codes Regulating the Design, Construction and Use of Buildings
- APHA Policy Statement 2000-19, Public Health Role of the National Fire Protection Association in Setting Codes and Standards for the Built Environment
- APHA Policy Statement 200913, Building Code Development, Adoption, and Enforcement Problems Affecting Injury Prevention in, and Usability of, Homes and Other Buildings.

Here is what the last in this series, the currently active APHA policy 200913, stated:

"From ICC's beginnings, there were indications that public health was not as high of a priority for the ICC, as was a dominating business presence in the US building regulatory field. This concern regarding the relationship between the ICC and the National Association of Home Builders (NAHB) was first addressed in APHA Policy 99-16 and reiterated in APHA Policy 2000-19. When the longer-established National Fire Protection Association (NFPA), with its very large set of widely used safety standards, decided to develop a competing model building code, APHA adopted policy statement 2000-19 to help influence NFPA in a more public health-oriented approach to model building code development. . . .

Much of what was recommended to NFPA in APHA's policy 2000-19 was implemented in NFPA codes and standards during the next several years, including, in 2003, mainstreamed safety and usability requirements for the most dangerous element in homes, the stairways. . . .

The model code development process, especially within ICC's system of public hearings, is based on a model encouraging adversarial testimony and other formal input to the process. Certain issues typically pit advocates for public health goals (such as safety and accessibility or usability of the built environment) against certain industry representatives whose goals are to have little or no change in established, traditional practices; to experience minimal regulatory interference; and to claim often that housing affordability will be harmed. . . .

As a general rule, there is no epidemiological or etiological basis for the traditional double, lower standard for home stair step geometry or for inferior handrail provision or functional quality; this was a point made explicitly in APHA's Policy 2000-19. NFPA has taken this issue to heart in its post-2000 revisions to its leading codes; ICC has gone in the opposite direction, increasing the gulf of safety and usability levels between home stairways and those in other settings. . . .

Therefore the APHA recommends: . . . 5. ICC and NFPA should develop and maintain model codes and standards requiring

home stairways to be designed and constructed so that stairs and railings provide at least the same level of usability and safety from falls as do stairs and railings in other buildings.”

Now, almost two decades after ICC published first editions of the IBC and IRC, ICC continues to ignore the evidence of stairway safety issues as well as the formally adopted policies of the American Public Health Association, APHA. Here follow highlights of that evidence, including Injury Epidemiology and Etiology.

Injury Epidemiology

Stairways. Since 2002, approximately the time that the IRC began to influence home stairway construction, medically-treated injuries in all settings—sufficient to lead to hospital emergency room visits—*increased by about 39 percent as of 2017 in the USA.* (This equates to a growth rate of about 2 percent a year over the 15-year period.) During this 15-year period, US population only increased by about 13 percent, that is with a demographic growth only about one-third that of stair-related injuries.

Also during this period there appears to have been an increase in the proportion of stairway related injuries occurring in home settings for which the location data are not as complete. For known locations, the home-based proportion has increased from about 85 percent to about 90 percent or higher over the 15-year period.

Stairs Compared to Fires. During this same 15-year period, *fire-related fatalities* in all US settings—with homes again being the most common site of fatalities—*decreased* with the approximate rate, per 100,000 population dropping from about 1.3 to about 0.98 injuries annually per 100,000 US population.

Comparison of stair-related *injuries* with fire-related *injuries* is complicated by the lack of detail about the nature of treatment needed for the fire-related injuries. For stair-related injuries, that are professionally treated, the treatment rates per 100,000 US population are displayed in Table 1 for the annual averages over the years 2010 to 2014: the average injury rate was about 1,400 per 100,000 population. At about the same time, fire-related injuries (based on 2016 figures from the US Fire Administration) had a rate of about 45 injuries per 100,000 and they were declining. (The resulting ratio of stairways to fire is about 31, a factor depicted in Figure 1.) There were some age differences for fires with rates of 55 for middle-age adults, 25 for children and 45 for older adults, all per 100,000 population. By contrast, during the period 2010-2014, *annual rates* for stair-related injuries, per 100,000 population, that resulted in professional medical care, are described in more detail in Table 1, right to left: for Doctors Offices or Outpatient Clinics, for Emergency Departments, and for Hospital Admission.

Stairs Age	Doc/Outp	ED	Hospital-admitted		Total
			via ED	Direct	
00-09	369.2	327.1	10.7	3.7	710.8
10-19	569.9	290.6	5.4	2.0	867.8
20-29	962.0	453.2	10.6	3.5	1,429.2
30-39	1,381.9	454.3	13.9	4.7	1,854.8
40-49	1,489.6	406.3	21.7	7.2	1,924.8
50-59	1,164.3	342.9	34.6	11.9	1,553.6
60-69	905.9	298.2	52.3	17.8	1,274.2
70-79	981.6	374.4	101.2	34.1	1,491.3
>=80	917.0	478.0	200.4	54.7	1,650.1
Total	980.5	374.5	31.5	10.2	1,396.7

Table 1. Annual US Injury Rates for Stairs
(per 100,000 population), by treatment and age, during 2010-2014
(Source: Pacific Institute for Research and Evaluation, Maryland)

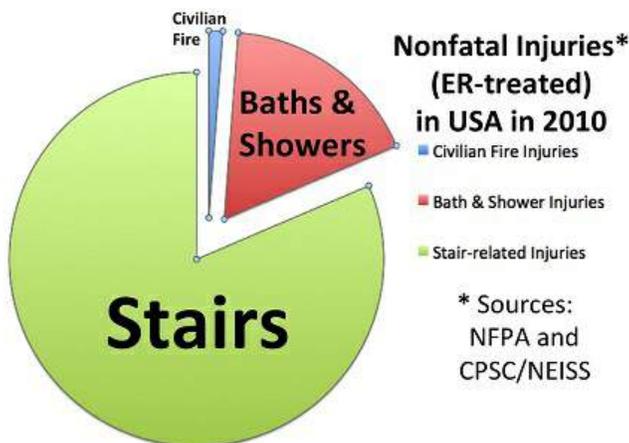


Figure 1. Chart of Approximate Relative Occurrence of Serious Injuries Associated with Three Common Dangers in Homes and Other Buildings

Comparing these stairway-related rates, with their enhanced specificity, in Table 1, with those noted earlier for fires, we should note the much larger public safety problem posed by stairways, compared to fires. From Figure 1 we should recognize that there is great disparity of code response to injury occurrence for stairways, along with another badly neglected topic in the IRC, fall prevention for bathtubs and showers (the subject of another set of proposed changes to the IRC).

To fully appreciate the size of the stairway safety problem in the USA, Table 2 provides estimates of incidence, annually, of injuries by treatment type and victim age.

Stairs Age	Doc/Outp	ED	Hospital-admitted		Total
			via ED	Direct	
00-09	149,389.0	132,344.0	4,313.0	1,515.8	287,561.8
10-19	240,132.0	122,449.0	2,288.5	824.6	365,694.1
20-29	422,114.0	198,838.0	4,634.7	1,533.7	627,120.4
30-39	560,978.0	184,438.0	5,628.9	1,910.3	752,955.2
40-49	634,787.0	173,156.0	9,241.0	3,050.3	820,234.3
50-59	502,896.0	148,100.0	14,928.3	5,133.4	671,057.7
60-69	286,908.0	94,429.1	16,556.9	5,644.9	403,538.9
70-79	173,515.0	66,176.8	17,891.0	6,021.7	263,604.5
>=80	106,489.0	55,507.0	23,272.4	6,356.7	191,625.1
Total	3,077,207.0	1,175,439.0	98,754.8	31,991.4	4,383,392.2

Table 2. Annual US Injury Incidence for Stairs by treatment and age, during 2010-2014
(Source: Pacific Institute for Research and Evaluation, Maryland)

The overall total, of over 4 million professionally treated injuries annually in the USA (within the period, 2010-2014), related to stairways, is mind blowing as is the huge societal cost of such injuries. During 2010-2014, the average *annual* societal cost of stairway-related injuries in the USA was estimated as over \$92 billion (2009 US dollars) and the vast majority of those injuries were in homes. (Source: Lawrence, B., Spicer, R., Miller, T. A fresh look at the costs of non-fatal consumer product injuries. *Injury Prevention*, digital publication, August 2014, paper journal publication, 2015:21:23-29.0)

Some Preliminary Cost-Benefit Insights. If we assume, as an approximation, there were about 120 million US households in 2012 (the midpoint in the periods discussed above) and further assume an average of one flight of stairs for each household (with some homes having several flights of stairs and many having none), the average cost of home stairway-related injuries is roughly \$700 per stair flight (or household) *per year*. This average injury cost greatly exceeds the annual cost (e.g., over a 50-year service life) of a stair flight in a home. As currently allowed by the IRC and built into new homes, stairways with such high annual injury costs are an extremely poor investment in terms of costs to society, families and individuals. Why this is the case is discussed in the next section, on etiology, the study of causes (of bad events such as disease, injuries, etc.).

Injury Etiology for Stairways

There is widespread agreement—*about the very prominent, indeed central role of stair step dimensions (among several stairway design and construction factors)*—among all the experts on stairway safety who have researched the topic and have been lead authors of papers, book chapters, a book or producer of widely viewed, edited video programs. Many have worked at, or for, the leading building science and technology centers in Japan, Britain, Australia, Sweden, Canada and the USA during the last six decades. All of the following individuals, listed alphabetically, have addressed various aspects of stairway use, safety and design; all have published authoritatively on one or more of these topics. Most have had long-term contact with the proponent. ***All favor improvements in stairway design to reduce the toll of injuries seen internationally over the last several decades.***

- Dr. John Archea (deceased), USA
- Dr. Susan Baker (retired)
- Dr. Ben Barkow, USA and Canada
- Dr. Peter Barss, MD, Canada
- Dr. Michael Brill (deceased), USA
- Dr. Daniel Carson (deceased), USA
- Dr. Harvey Cohen, (retired) USA
- Dr. Nancy Edwards, Canada
- Dr. Nigel Ellis, USA
- Dr. Geoff Fernie, USA
- Dr. John Fruin, (retired) USA
- Dr. Tom Hay, Canada
- Dr. Charles Irvine (deceased), USA
- Dr. Daniel Johnson, USA

- Dr. Satoshi Kose, (retired) Japan
- Dr. Lennart Kvanstrom (deceased), Sweden
- Dr. Hamish MacLennan, Australia & New Zealand
- Dr. Hisao Nagata, (retired) Japan
- Dr. Alison Novak, Canada
- Dr. Marcus Ormerod, UK
- Dr. Joan Ozanne-Smith, Australia
- Dr. Jake Pauls, Canada & USA
- Mr. Mike Roys, UK
- Dr. Gary Sloan, (retired) USA
- Dr. Edward Steinfeld, USA
- Dr. Leif Svanström, Sweden
- Dr. John Templer, (retired) USA
- Dr. Keith Vidal, USA
- Dr. Michael Wright, UK

Both Sides of the “7-11” Proposal for Home Stairs Debated. There are relatively few people who have argued on the reactionary, industry side of the long-running debate about improving the design of stairways. One published example of an extended debate on the topic of improved home step dimensions dates back to 1985 (Dacquisto, D.J. and Pauls, J., 1985, The “7-11” stair: Should it be required for residential construction? *The Building Official and Code Administrator*, May-June, pp. 16-35.) David Dacquisto represented the National Association of Home Builders in this published debate. Jake Pauls represented scientific plus technical perspectives, e.g., based on research and public health evidence. The “Yes” side of published, 12-page account of the debate, in the BOCA magazine, was based on an 8,000-word position paper by Pauls.

Here follow concluding remarks in both sides’ lengthy arguments, with Pauls’ remarks selected for roughly comparable length and subject focus:

Dacquisto, for the NAHB. “What should be the standard for deciding whether to adopt a code proposal which faces opposition? Both cost and benefit estimates will always be uncertain. A suggested minimum standard is that no regulatory proposal should be finally approved over opposition unless the regulatory body finds it more likely than not that benefits of the proposal will exceed the costs, and believes there is probably no less costly way to achieve the anticipated benefits. The burden of proof should be on the proponent. By this standard, for the reasons presented in this article, the residential 7/11 stair proposal appears unwarranted at the present time.”

Pauls, for many experts and consumers “. . . Clearly, judging from the technical literature, the disagreement among apparently, “reasonable people” is certainly not great enough to give any real comfort to those trying to justify continuation of very poor step geometry standards for residential stairs. Also, despite Mr. Dacquisto’s apparent attempts to conceal the fact, literature produced by “reasonable people” generally calls for residential stair geometry that is similar to and sometimes better than, what is expected elsewhere. . . .”

Today, over three decades after the above debate, the evidence has grown significantly, *both from epidemiology and etiology*, for improving home step dimensions, specifically to the “7-11” standard—with maximum 7-inch rise and minimum 11-inch tread depth or run. Mr. Daquisto’s criterion (for “7-11” adoption) about evidence, “that benefits of the proposal will exceed the costs,” has been repeatedly provided, including being the lead subject in Pauls’ IRC proposal, in 2003, for the “7-11” rule—*submitted sixteen years and five editions of the IRC ago—16 years including over 40 million US stair related injuries and about \$900 billion in US stair-related, societal injury costs!*

During the 16 years, specifically 2010, Jake Pauls attempted a second set of proposals to update both the IBC and the IRC with respect to home stairway safety, specifically the step dimension rules. That led to a formal appeal to ICC after which the ICC Board refused to deliberate on the matter with the appellant and his counsel. ICC’s refusal to properly address the home stairway safety issue extends right to the top of the organization.

This era of three major attempts to change the ICC codes requirements will end with the current proposal in 2019 after which the effort will be moved—painfully for ICC, the building regulatory field, the building industry, and others—increasingly into the litigation arena as has already gained some momentum in Canada where a significant portion of forensic assignments (of the proponent’s, especially in Ontario) are now in home settings in relation to injuries due to defective stairs.

History within ICC — 2003. The first major public proposal in March 2003, by Jake Pauls, to ICC to change the IRC home stair step dimension requirements to the “7-11” standard was over 18,000 words in length. In addition to epidemiology and etiology aspects of the issue, the proposal dealt extensively with benefit-cost and other issues.

Here is the outline of the entire proposal.

- ICC Public Proposal Form identifying proponent, etc.
- Legislative Text of Proposed Changes (to sections similar to those now addressed).
 - R311.5.3 Stair treads and risers.
 - R311.5.3.1 Riser height.
 - R311.5.3.2 Tread depth.
 - R311.5.3.3 Profile.
- Benefit-Cost Analysis for Improved Stairs in the USA

- Injury Epidemiology
- History of Debate on Improved Step Geometry Requirements in Codes & Standards
- Benefits and Costs
- Industry's and Regulators' Reviews of Research
- Latest Research on Step Geometry from Britain

• Politically-driven Local and State Adoption Process

- Building and Marketing Improved Stairs
- The Problem of the Double Standard
- Intimidation of Building Officials
- Roles of NFPA and APHA
- Summary

Some of these topics are still as relevant today as they were in 2003 and a brief update on these is provided below. Nearly an identical proposal was submitted to NFPA in parallel with the ICC proposal during 2003. An NFPA task group was set up to advise on the issue; it strongly recommended adoption. A rule about 7-11 stairs across the board—especially in homes—was adopted. NAHB appealed and lost. Since then NAHB has given up trying to get the NFPA dwelling unit requirements to revert to what the IRC has. Rather, NAHB turned its efforts to stopping NFPA and others from improving home safety through model code adoption at state and local levels in the USA. ICC appeared to be a willing partner in this effort. Ethics apparently took a back seat as ICC continued to give NAHB a guaranteed one-third of the relevant IRC committee's 12 positions and thus needed only two votes to stop any proposal it did not like. Proponents require 7 votes. The math is clear, as is the need for legal intervention where evidence is treated in much higher regard and nobody with a pre-determined position is allowed to serve as a trier of fact, such as a judge or jury member. **NAHB's Political Opposition Spanning Over Two Decades.** The 2003 proposal was not accepted by ICC, largely for what will be termed "political considerations" namely that ICC was not prepared to go against NAHB's bullying (and other forms of power-based influence) against ICC and building officials generally. Indeed, the political power of the NAHB continues, with ICC's apparent *and effective blessing*, two decades after NAHB adopted, in 1996, a policy that stated: "NOW THEREFORE BE IT RESOLVED that the National Association of Home Builders recommends that all state and local governments who adopt the National Building Code (BOCA) and the Council of American Building Officials (CABO) model building codes, postpone the adoption of any new stair geometry,

BE IT FURTHER RESOLVED that the National Association of Home Builders recommends that all state and local governments who automatically adopt BOCA and CABO model building codes, amend the 1996 and 1995 editions respectively to continue the use of the 1993 BOCA and CABO model codes as they relate to stair geometry provisions,

BE IT FURTHER RESOLVED that the National Association of Home Builders urges all state and local affiliated Home Builders' Associations to contact state and local code authorities and persuade them to postpone the adoption of the new CABO and BOCA stair geometry standard, and

BE IT FURTHER RESOLVED that the National Association of Home Builders continue to vigorously pursue the adoption of a stair geometry standard consistent with the 1993 BOCA Code."

The 1993 *BOCA National Building Code* still permitted stairs in dwelling units to have a maximum riser height of 8.25 inches (210 mm) and a minimum tread depth of 9 inches (229 mm); this contrasted with the same Code's requirements for the "7-11"-based standard for other buildings and occupancies.

Role of Stair Step Dimensions. This topic is the most researched aspect of stairway safety and it has a history dating back centuries, indeed, a few millennia (as set out in detail in the proponents 2003 proposal to ICC. This history was described in detail in the proponents proposal in 2003 and will not be repeated here (although, if necessary, it will be part of a comment submitted during 2019 for consideration at the Public Comment Hearing this autumn). Staff can provide the appropriate code change committee with that 2003 proposal if there is a demand from committee members. (It can also be provided to ICC by the proponent if necessary as a PDF file.)

UK Research Findings. Since the turn of the century, about two decades ago, there was extensive stairway safety research in the UK at the Building Research Establishment (BRE), a UK version of US NIST or NRC Canada's former Division of Building Research (up to about 1982). It was briefly noted in the proponent's 2003 and 2010 proposals on the step dimension issue in the IRC. The charts below are based on many charts and other results produced for the BRE's sponsor the national agency in the UK responsible for its building regulations. BRE's research included (1) laboratory studies of ten different stair step run (going or tread depth) dimensions and several different rise dimensions and (2) a mail-back survey of home owners home stair dimensions combined with a survey of falls on their stairs in the preceding two years.

Figure 2 shows one of many results based on both objective measures and test subjects' responses to a multi-item questionnaire used for each combination of experimental stair rise and run.

What we found out: "I felt safe walking down the stair"

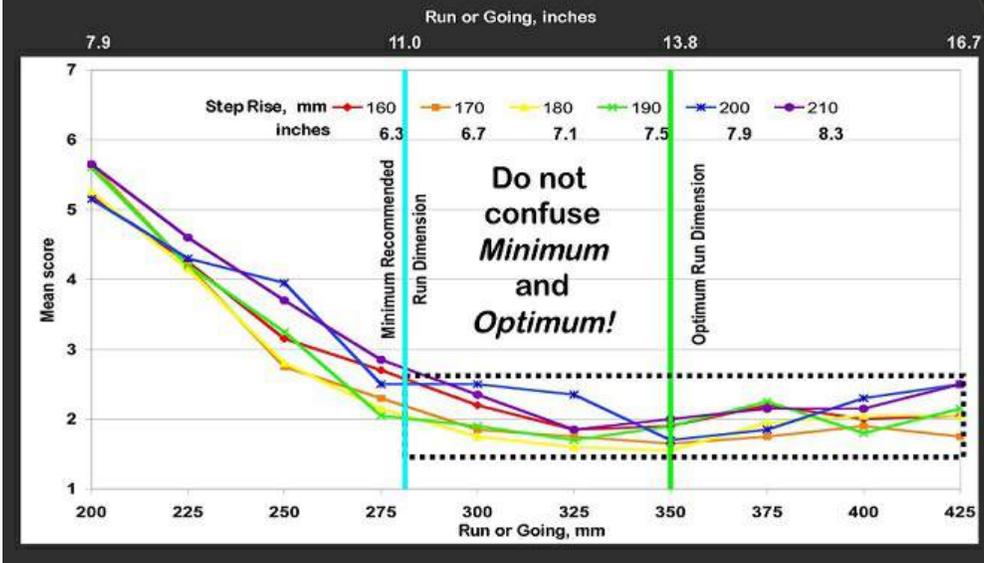


Figure 2. Results of BRE Laboratory Testing of Combinations of Step Rise and Run/Going, Here Assessed by the Best Subjective Measure

Figure 2 is the chart for the most valuable question or assertion for which the study team wanted to know extent of agreement by individual subjects using a scale for which the lower score is associated with a more-preferred step geometry combination. The results, shown in Figure 2, are for the statement, "I felt safe walking down the stair." There is a streaming video of a discussion between the proponent and one of the two co-investigators, Mike Roys, posted at www.bldguse.com. The discussion, in 2017, focused on the relative importance of the two variables—rise and run—influencing the actual and perceived safety of a stair. While step run (tread depth in the IRC) is very important, there is also some notable effect of the rise. Further research, with larger samples of test subject are needed to pin this down (i.e., statistical significance which was established for the run).

The results of the laboratory studies and the field survey were very similar to what is presented in Figure 3. It shows—for run dimension only—the combined results of the BRE mail-back survey and the laboratory testing; this shows the close correspondence of both subjective and objective measures of the increasing danger of falls when the run dimension is smaller. The vertical scale of the graph in Figure 3 was the basis for estimates, below, on relative risk of falls sufficient to warrant a visit to a hospital Emergency Department in the US.

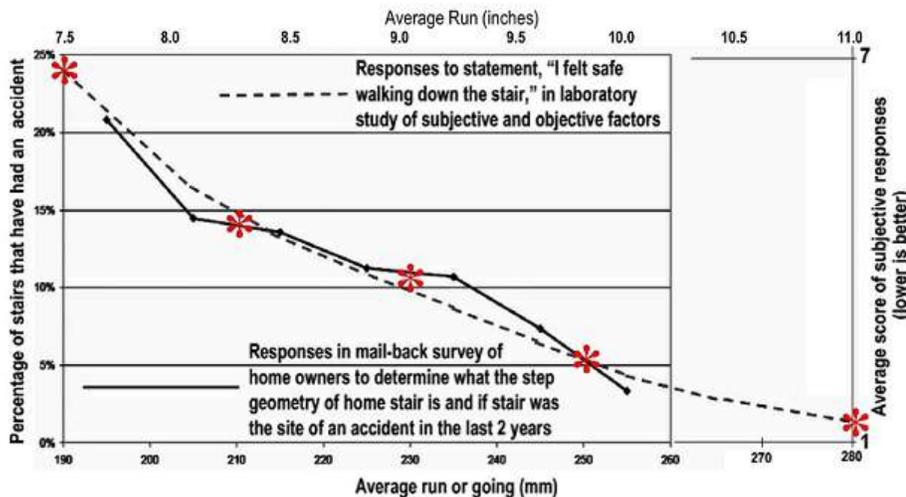


Figure 3. Combined Results of BRE Laboratory Testing of Combinations of Step Rise plus Run/Going and the Results of a Mail-back Survey about Home Stair Dimensions

The proponent, working with original reports of the UK studies as well as numerous meetings with the UK researchers, at BRE and elsewhere, prepared a table which is partly reproduced below, as Table 3, based on a 2013 publication, that described how step run or tread depth ("going" in UK terminology) affected the risk of an injurious fall sufficiently serious to warrant a visit to a hospital Emergency Department. The range of run (tread depth) dimensions in the table ranged from 190 mm (7.5 inches) to 280 mm (11 inches). (These results and the full table partly reproduced as Table 3 are found in: Pauls, J. and Barkow, B., 2013. Combining risks from two leading factors in stair-related falls. *Proceedings*

Uniformity condition: Percentage of stairs with TOFF	Annual injurious fall risk rates with various nominal tread runs Risk rates shown are per 100,000 population				
	190 mm Effective run with carpet	210 mm	230 mm Favoured by US home builders	250 mm Minimum in ICC codes	280 mm Minimum in NFPA codes
0	230	140	110	50	20

Table 3. Small Portion of Published Table: Estimated relative annual risks per 100,000 population, of US hospital emergency department visits for home stair-related falls with various nominal run (going) dimensions and with various occurrences of Top of Flight Flaw (TOFF) non-uniformity

Injury Consequences of Inferior Stairs Resulting from NAHB’s Policy and ICC’s Refusal to Improve Home Stair Step Dimensions.

What these and many other research findings mean today is that, across much of the USA, there is mix of inferior—indeed *dangerously inferior*—stairs in homes in their second decade (or more) of a several-decade life. Such homes with stair step tread depths or runs of only 9 inches (even an inch or more smaller effectively, with carpet coverings) are injuring home occupants at rates exceeding those achievable with “7-11” step dimensions by a factor of as much as six to eight. In standard epidemiological terms such NAHB-demanded, home stairs are associated with—per 100,000 population—at least 110 stair-related injuries—annually—leading to hospital emergency room (ER) treatment compared with 20 stair-related injuries for stairs meeting the “7-11” standard. (This relationship and the role of dimensions both nominal and with nonuniformities are discussed in detail in the Pauls-Barkow paper, from 2013, cited above in relation to Table 3.)

Injury Costs. As seen in Table 2 (near the front of this substantiation), for the entire US, in 2018, the ER-treated injury toll alone for such NAHB-demanded stairs is estimated to be on the order of 600,000 injuries. Adding other treatment consequences, i.e., doctors offices and clinics along with hospital admissions brings the annual injury toll into the millions in the US with a societal cost on the order of 100 billion dollars or approaching \$1,000 per average US household annually. Note that, societal injury costs for such injuries are composed of three components: medical care, work loss and other direct economic losses, plus pain and suffering (quality of life generally) which are, roughly, in the ratio: one : two : seven, respectively. In other words, medical care cost is the smallest of three components responsible for only about 11 percent of total, societal costs. See figure 4.

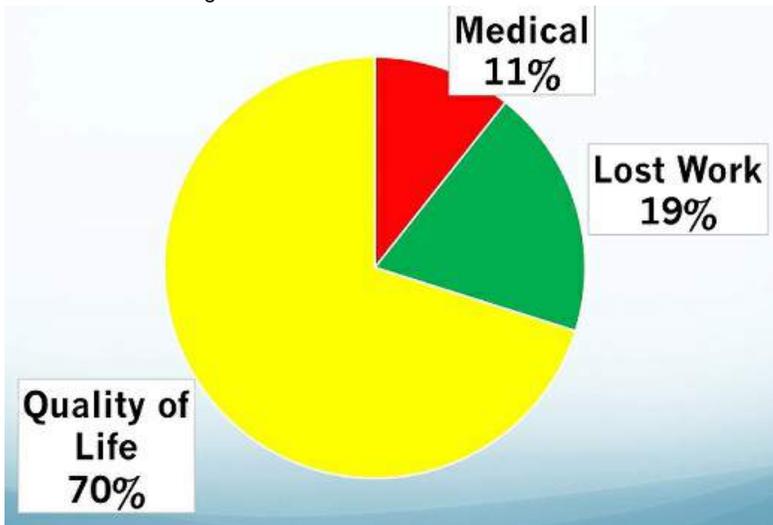


Figure 4. Components of Societal Injury Cost

Benefits of Normal Stairway Use. Moreover, during a year period, there are on the order of one-trillion stair flight uses in the USA, everyone of which has a value to the stair users. Such normal uses have a significant value that must be taken into account in any benefit-cost analysis. This will increasingly be the case as stairs become safer to use—due to design improvements—and thus such uses can be confidently recommended as a good source of exercise our increasingly sedentary populations need for better fitness. Currently, this proponent cannot endorse use of typical US (or Canadian) home stairs for exercise purposes. Exposure to predictable and preventable dangers has to be minimized and this means that a valuable, readily available place to exercise has less value over its lifetime, simply because its design and construction have been dictated largely by two organizations in the USA: NAHB and SMA, using a flawed code-development process maintained (in an otherwise laudable process for example for its openness and use of communication media) by the ICC.

Concluding Remarks

There are two tactics currently being utilized to change the IRC requirements, one uses ‘micro-surgery’ to change the smallest amount of text in IRC Section on Stairways, focused only on the step dimension issue in relation to specifying minimum tread depth (run) and maximum rise. This would change minimum tread depth from 10 inches to 11 inches and would change maximum rise from 7.75 inches to 7 inches. The other tactic takes a more-comprehensive approach, substituting almost all IRC’s requirements for stairways through a mandatory reference to NFPA 101’s requirements on home stairways, specifically for one- and two-family dwellings—the same scope as the IRC has.

In the proponent's professional opinion, the first tactic addresses a problem largely created and maintained by the NAHB; the other adds issues for which the SMA is largely responsible due to its largely poorly justified tinkering with a wider range of stairway design issues which owe more to tradition than to technology. SMA's approach has been marked by the attempt to keep building what has been built in the past, without adequate scientific and technical justification. It appears that SMA has fared very poorly in attempting to do this in the NFPA process where scientific and technical justification carries more weight.

In the proponent's professional opinion, both the NAHB and SMA bear much responsibility for the sorry state of home stairway safety in facilities built to the IRC. Ultimately it is ICC that has failed, and—unless drastic actions are taken—will continue to fail us with huge injury ramifications that will last for many decades. This raises questions about the Preface to the IRC which states: (ICC) "provides an international forum for discussion and deliberation about building design, construction methods, safety, performance requirements, technological advances and innovative products." If this were completely true, why do the requirements of the IRC differ so significantly from those adopted by NFPA?

With the "7-11" being, now, a long-established standard for stairway safety—including in the *International Building Code* for all settings except one- and two-family dwellings, why is the "7-11" not applied to the setting where it is most needed and where it would produce the largest benefit for the cost of implementation—*in homes?*

Bibliography: All citations to the published literature are embedded in the Reason Statement

Cost Impact: The code change proposal will increase the cost of construction

While cost of construction will increase, that increase (as shown also in the first proposal on this same topic in a 2003 proposal on stairways in the IRC) pales in comparison to the benefits of the "7-11" step geometry for dwelling unit stairs. (From the Reason Statement comes the following updated detail on cost impact.

"If we assume, as an approximation, there were about 120 million US households in 2012 (the midpoint in the periods discussed above) and further assume an average of one flight of stairs for each household (with some homes having several flights of stairs and many having none), the average cost of home stairway-related injuries is roughly \$700 per stair flight (or household) *per year*. This average injury cost greatly exceeds the annual cost (e.g., over a 50-year service life) of a stair flight in a home. As currently allowed by the IRC and built into new homes, stairways with such high annual injury costs are an extremely poor investment in terms of costs to society, families and individuals."

Moreover, for all the other changes proposed for Section 311.7, there is actually a reduction of cost for handrails for example as the more functional handrails are also less costly than the ones typically provided for new home stairways. Changes such as lighting of stairways also have a minor impact on costs as, with modern lighting control systems and energy-saving sources, lighting with increased illumination levels that operates as needed, automatically, means this is not costly as in the past.

Staff Analysis: The referenced standard, NFPA 101-18, is currently referenced in other 2018 I-codes.

RB116-19

Public Hearing Results

Errata: This proposal includes the following errata

Editorial revision as follows: If the final action on this proposal is Approved as Submitted, or Approved as Modified, The NFPA 101 standard will be added to Chapter 44.

Committee Action:

Disapproved

Committee Reason: This would require that NFPA 101 be bought for every inspector. The IRC is intended to be a standalone code and this defeats the purpose. We need a work group to gather empirical data on this issue. (Vote: 10-0)

Assembly Action:

None

RB116-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R311.7

Proponents:

Jake Pauls, representing self (bldguse@aol.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R311.7 Stairways. Stairways shall comply with Sections R311.7.1 through R311.7.12.2 or the stairway requirements of NFPA 101 for one- and two-family dwellings.

Commenter's Reason: The ICC IRC-B Committee provided only three reasons for disapproving RB116-19.

I concede that all three reasons have validity but only the third is responsive to the development of a path forward. Such a path—and its utilization as soon as possible—appears to me to be the only acceptable solution to the problem of a very flawed section of the IRC.

My main purpose in submitting this comment is, as was noted in my testimony at Albuquerque, to get this problem understood by—and addressed by ICC voting members. When they see the extent of the problems with the IRC stairways section, they will—I hope—press the ICC leadership to begin seriously to address the underlying problems. One is the excessive power given (in the late 1990s) to the home building industry in setting standards for minimum safety of one and two-family dwellings. As a member of ICC's Industry Advisory Committee (representing, as I do to this day, the American Public Health Association, APHA) I objected strenuously when the voting power on the IRC committees was given to the NAHB. In my professional opinion, that was a dreadful error on the part of the ICC Board. My opinion was later backed by formally adopted public policy positions by APHA (still in effect today).

In the meantime, NFPA maintained a progressive position with regard to design of one and two-family dwellings, notably on the issue of stairway usability and safety. This was reflected in its 2003 and subsequent editions of NFPA 101 and NFPA 5000. Meanwhile, much of what ICC was producing not only failed to adequately respond to the need for improved requirements for stairways and, even worse, some requirements were made even worse because proposed changes were not based on the best available evidence on usability and safety (as developed by professionals in public health and ergonomics for example).

There were other process issues that ICC lost sight of relative to what its predecessor organization, CABO, had been doing with its Board for the Coordination of the Model Codes (BCMC). Especially notable were BCMC's 1985 Report on Means of Egress and its 1993 report mainstreaming several key stairway safety requirements from their original scoping only for public buildings to include one and two-family dwellings. The recommended mainstreaming of the "7-11" step dimension rule as well as research-based handrail graspability (as well as general scoping) requirements are especially important here.

The time is now right for the ICC Board to recognize that, despite many successes in ICC, there is a growing concern about stairways—and the expanding needs of their users—to be treated with greater respect for evidence-based design standards addressing very serious ergonomic and public health shortcomings. Here we are talking about over one-hundred billion dollars annually for stair related injuries—90 percent in homes—in the USA alone. We need another BCMC-type effort that brings multiple code groups and perspectives to the discussion table.

I have tried, over the years to get the ICC Board to be responsive on these matters without success. If this continues, more desperate measures will have to be resorted to, including (potentially) having ICC named as a third-party defendant in legal actions seeking compensation for predicable and preventable injuries, especially in homes. To borrow from Shakespeare, "let's skill the lawyers."

I work closely with lawyers in my international professional practice. The ergonomic and public health evidence I bring to this professional activity has resulted, over about two recent years, to my being conferred with an Honorary Doctor of Science degree from a University known worldwide for its cutting-edge work on movement of people in built environments. Last October another university, in the US, conferred the first new award named in my honor, the Jake Pauls Award for Advocacy in Building and Fire Safety.

It is now time to have ICC join others in addressing the serious problems of home safety. Stairways (and bathtub and shower safety) are problems I am addressing (advocating on behalf of consumers) currently. I would very much like to have ICC join the effort and become part of the solution

rather than being part of the problem.

Finally, I would welcome any ICC chapter approaching me (at bldguse@aol.com) with a request to provide a custom presentation of a no-charge, half-day workshop to its members on not just the stairway safety issue but that of bathtub and shower safety (as addressed in my IRC proposal IRC81-19 and a public comment). Preferably that could be done prior to the Public Comment Hearings in Las Vegas but, if only possible later, that would be helpful in Chapter demonstration of real concern about these leading home-related injury topics that must be better addressed in ICC codes as well as in code enforcement procedures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. See information in original RB116-19.

Public Comment# 2133

RB119-19

IRC@: R312.1.2, R312.1.3

Proposed Change as Submitted

Proponents: Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov); Gary Traver, representing NYS Department of State (gary.traver@dos.ny.gov)

2018 International Residential Code

Revise as follows:

R312.1.2 Height. ~~Required-Where installed.~~ *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) in height as measured vertically above the adjacent walking surface or the line connecting the *nosings*.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height of not less than 34 inches (864 mm) measured vertically from a line connecting the *nosings*.
2. Where the top of the *guard* serves as a handrail on the open sides of stairs, the top of the *guard* shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) as measured vertically from a line connecting the *nosings*.

R312.1.3 Opening limitations. ~~Required-Where installed.~~ *guards* shall not have openings from the walking surface to the required *guard* height that allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a *guard*, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. *Guards* on the open side of stairs shall not have openings that allow passage of a sphere $4\frac{3}{8}$ inches (111 mm) in diameter.

Reason: The way the language is currently written, only required guards need to meet the height and opening limitations. Meaning guards on a low (30 inches or less above grade) deck, installed voluntarily as a design choice, are permitted to be lower than 36-inches and with openings which would allow small children to get caught in. Just like many other code provisions, if a component is installed, whether it is required or not, it should meet the safety requirements of the code instead of providing a false sense of security.

Cost Impact: The code change proposal will increase the cost of construction

This change will likely marginally increase the cost of construction for those elevated walking surfaces that are 30 inches or less that voluntarily choose to install guards.

RB119-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There was no data or research provided to indicate that guards are needed at all drop offs. This proposal creates problems from an enforcement standpoint. (Vote: 11-0)

Assembly Action:

None

RB119-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R312.1.2, R312.1.3

Proponents:

Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (jeffrey.hinderliter@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R312.1.2 Height. ~~Required~~ ~~Where installed,~~ *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) in height as measured vertically above the adjacent walking surface or the line connecting the *nosings*.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height of not less than 34 inches (864 mm) measured vertically from a line connecting the *nosings*.
2. Where the top of the *guard* serves as a handrail on the open sides of stairs, the top of the *guard* shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) as measured vertically from a line connecting the *nosings*.

R312.1.3 Opening limitations. Where installed, *guards* shall not have openings from the walking surface to the required *guard* height that allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a *guard*, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. *Guards* on the open side of stairs shall not have openings that allow passage of a sphere $4\frac{3}{8}$ inches (111 mm) in diameter.

Commenter's Reason: RB119-19 should be Approved as Modified by This Public Comment.

The original proposal reason focused on addressing non-required guards being installed in an unsafe or insufficient manner. The opposition to the proposal centered around a reluctance to modify the height requirement of Section R312.1.2 by replacing the word "Required" with "Where installed." After discussing the issue further, there is valid concern of what constitutes a "guard" and the potential for misinterpretation.

Therefore Section R312.1.2 should remain unchanged from the 2018 IRC language.

However, there was general agreement that entrapment and strangulation were valid concerns. Therefore, this public comment proposes that the original proposal be revised to only change Section R312.1.3. A child being entrapped in an opening is a valid concern at any height. While a child may not be strangled at a height of less than 30 inches, the potential for other injuries is still present. The 2018 IRC Commentary states: "*Guards must be constructed so that they prohibit smaller occupants, such as children, from falling through them.*" (Page 3-116) If a guard is installed, the guard should not become a hazard and should still prohibit smaller occupants from falling through.

Bibliography: 2018 IRC Code and Commentary—Volume 1. First Printing, Vol. 1 of 2, International Code Council, 2018.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This change will likely marginally increase the cost of construction by requiring more material and labor to construct guards meeting the opening limitations. This will not require any new guards in places the code currently does not require them.

Public Comment# 1550

Public Comment 2:

Proponents:

Thomas Zuzik Jr, of Railingcodes.com Representing NOMMA - The National Ornamental & Miscellaneous Metals Association, representing NOMMA - The National Ornamental and Miscellaneous Metals Association (coderep@railingcodes.com)

requests Disapprove

Commenter's Reason: The submitting proponents of RB119-19 have not provided any data or new research in their reason statement's

justification.

The charging statements "Where required" were re-affirmed as the correct requirement during the International Code Council's (ICC) - Code Technology Committee's (CTC) review and area of study regarding climbable guards from April 2005 through the publication of their final report in May 2008.

The CTC not only looked at climb-ability while doing the area of study, but also reviewed the height and opening limitations and when and where the requirements are needed. The final report cites the charging statement "Where required" in the multiple code change proposals submitted by the CTC during their review and the passing of the changes and recommendations brought forth by the committee through the ICC model code change process.

Additionally, when generalizing restrictions on non-required guards, how is one to interpret the installation of patio sidewalk separation for cafés and restaurants. Are these guards at ground level? When is something resembling a guard, now considered a guard?

The original proponents code change would drastically decrease the number of lower locations where non-required type "guards" live and are commonly being installed along low openings and at lower heights as architectural accents and providing a level of safety, compared to nothing being installed providing no safety at all.

During the CTC's area of study, the committee reviewed adding the charging statement of "where required" to the structural section also. From our interpretation of their review while attending the meetings, the CTC committee decided to leave that charging statement out of the structural section. The reason noted was the vast majority of people could see or feel the height of a non-required guard or the openings within a non-required guard, but they would not be able to determine if the non-required guard was structurally sound. Therefore, non-required guards are still subject to the structural requirements set forth within the current code, when deemed a non-required guard and not another type of architectural accent, per say fence.

Additionally, the proponent's direction will blur the line between free standing handrails and guards, for in the residential handrail and guard industry though the two items are not the same, a large majority of the time they are combined on stairs and ramps. In situations where only a handrail is required the result is that simple handrails will be scrutinized as guards, whether a guard is required or not.

Example: A (3) strand horizontal pipe handrail mounted on a 16-inch vertical rise ramp to a front porch at the beach. Applying this code change would now require this open air style handrail to have guard infill meeting the 4" sphere, simply because it looks like a guard and is at a low lying edge.

We have included in this request for disapproval pictures of an installed handrail and an architectural feature better known as a non-required guard. Both of which would no longer be compliant under the proponent's code change. (AIWNOMMA-01.jpg) & (AIWNOMMA-02.jpg).



The results of RB119-19 passing would end up requiring guards everywhere something similar was installed, and if the proponents intent is to have

more guards installed a better solution would be lowering the current height trigger point from 30 inches for when guards are required.

Bibliography: 1. International Code Councils - Code Technology Committee

CTC Committee working documents, meeting minutes and reports

<https://www.iccsafe.org/products-and-services/i-codes/code-development-process/ctc-area-of-study-climbable-guards/>

2. International Code Councils - Code Technology Committee

Area of Study Climbable Guards final report May 21st, 2008

https://www.iccsafe.org/wp-content/uploads/ctc/Final_Report_May_2008.pdf

3. Pictures supplied by NOMMA Membership

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No change to code.

Public Comment# 1623

RB125-19

IRC@: SECTION R314, R314.1, R314.1.1, R314.2, R314.2.1, R314.2.2, R314.2.3 (New), R314.3, R314.3.1, R314.4, R314.4.1 (New), R314.5, R314.6, R314.7, R314.7.1, R314.7.2, R314.7.3, R314.7.4

Proposed Change as Submitted

Proponents: Francis McAndrew, NYS Department of State, representing NYS Department of State (francis.mcandrew@dos.ny.gov); Ronald Stark, NYS Department of State, representing NYS Department of State (ronald.stark@dos.ny.gov)

2018 International Residential Code

Revise as follows:

SECTION R314 SMOKE ALARMS AND HEAT DETECTION

R314.1 General. Smoke alarms, heat detectors, and heat alarms shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be *listed* in accordance with UL 217. Heat detectors and heat alarms shall be listed for the intended application. Combination smoke and carbon monoxide alarms shall be *listed* in accordance with UL 217 and UL 2034.

R314.2 Where required. Smoke alarms, heat detectors, and heat alarms shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in *dwelling units*. A heat detector or heat alarm shall be provided in new attached garages.

R314.2.2 Alterations, repairs and additions. Where *alterations*, *repairs* or *additions* requiring a permit occur, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwelling units*.

Exceptions:

1. Work involving the exterior surfaces of *dwelling units*, such as the replacement of roofing or siding, the *addition* or replacement of windows or doors, or the addition of a porch or deck.
2. Installation, alteration or repairs of plumbing or mechanical systems.

Add new text as follows:

R314.2.3 New attached garages. A heat detector or heat alarm rated for the ambient outdoor temperatures and humidity shall be installed in new garages that are attached to or located under new and existing dwelling units. Heat detectors and heat alarms shall be installed in a central location and in accordance with the manufacturer's instructions.

Exception: Heat detectors and heat alarms shall not be required in dwelling units without commercial power.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional *story* of the *dwelling unit*, including *basements* and *habitable attics* and not including crawl spaces and uninhabitable *attics*. In *dwelling units* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.
4. Smoke alarms shall be installed not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by this section.

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.

Revise as follows:

R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual *dwelling unit*. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Smoke alarms and alarms installed to satisfy Section R314.4.1 shall not be required to be interconnected to existing smoke alarms where such existing smoke alarms are not interconnected or where such new smoke alarm or alarm is not capable of being interconnected to the existing smoke alarms.

Add new text as follows:

R314.4.1 Heat detection interconnection. Heat detectors and heat alarms shall be connected to an alarm or a smoke alarm that is installed in the dwelling. Alarms and smoke alarms that are installed for this purpose shall be located in a hallway, room, or other location that will provide occupant notification.

R314.5 Combination alarms. Combination smoke and carbon monoxide alarms shall be permitted to be used in lieu of smoke alarms.

Revise as follows:

R314.6 Power source. Smoke alarms, alarms, and heat detectors shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

R314.7 Fire alarm systems. Fire alarm systems shall be permitted to be used in lieu of smoke alarms and shall comply with Sections R314.7.1 through R314.7.4.

R314.7.1 General. Fire alarm systems shall comply with the provisions of this code and the household fire warning *equipment* provisions of NFPA 72. Smoke detectors shall be *listed* in accordance with UL 268.

R314.7.2 Location. Smoke detectors shall be installed in the locations specified in Section R314.3.

R314.7.3 Permanent fixture. Where a household fire alarm system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner.

R314.7.4 Combination detectors. Combination smoke and carbon monoxide detectors shall be permitted to be installed in fire alarm systems in lieu of smoke detectors, provided that they are *listed* in accordance with UL 268 and UL 2075.

Reason: An estimated 9,000 residential garage fires are reported to United States fire departments each year and cause an estimated 50 deaths, 400 injuries, and \$557 million in property loss (NFPA Research Report: Home Structure Fires, September 2017).

Fires that originate in residential garages are normally larger, spread farther, and cause more damage than fires that start in other areas of a home. This is largely due to garages not having any means of smoke or heat detection. By the time a smoke detector in the dwelling detects the fire, or the home owner or a neighbor notices the fire, it is often too late, and the fire has begun to burn through the fire separation between the garage and the dwelling. At this point, the fire rapidly spreads through wall cavities and begins to attack the structural parts of the home. Unfortunately, smoke alarms installed in garages may lead to nuisance alarms due to vehicle exhaust fumes.

Installing a heat detector or heat alarm in these unprotected areas of a home will significantly reduce fire related deaths, injuries, and property loss.



Bibliography:

1. NFPA Research Report: Home Structure Fires, September 2017. <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Building-and-life-safety/osHomes.pdf>
2. FEMA Topical Fire Report Series: Residential Building Garage Fires (2009-2011). <https://www.usfa.fema.gov/downloads/pdf/statistics/v14i12.pdf>
3. USFA Prevent Home Garage Fires. https://www.usfa.fema.gov/downloads/pdf/publications/prevent_home_garage_fires_flyer.pdf

Cost Impact: The code change proposal will increase the cost of construction

- An interconnected heat detector or heat alarm will increase the cost of construction by about \$100, which includes installation.
- If a new garage is attached to an existing dwelling that has only battery powered smoke alarms installed, the heat detector or heat alarm will require the installation of an interconnected alarm or smoke alarm to be installed in the dwelling for the purposes of providing occupant notification. Under this scenario, the total cost will increase to about \$200.

RB125-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is already effective prescriptive fire protection for this in the code. There are several problems with the proposed text. Instead of referring to temperature and humidity, why not just refer to outdoor use? Regarding the construction section, there is no need to use the term "new" as that is the intent of the section. (Vote: 11-0)

Assembly Action:

None

RB125-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R314.1, R314.1.1, R314.2, R314.2.1, R314.2.3 (New), R314.4.1 (New), R314.6

Proponents:

Francis McAndrew, New York State Department of State Division of Building Standards and Codes, representing New York State Department of State Division of Building Standards and Codes (francis.mcandrew@dos.ny.gov); China Clarke, representing New York State Department of State Division of Building Standards and Codes (china.clarke@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

Replace as follows:

2018 International Residential Code

R314.1 General. Smoke alarms and heat detection shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be *listed* in accordance with UL 217. Heat detection shall be listed in accordance with UL 521 or UL 539, as appropriate for the intended application. Combination smoke and carbon monoxide alarms shall be *listed* in accordance with UL 217 and UL 2034.

R314.2 Where required. Smoke alarms and heat detection shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in *dwelling units*. Heat detection shall be provided in new attached garages.

R314.2.3 Attached garages. Heat detection rated for the ambient outdoor temperatures shall be installed in new garages that are attached to or located under new and existing dwellings. Heat detection shall be installed in a central location and in accordance with the manufacturer's instructions.

Exception: Heat detection shall not be required in dwellings without commercial power.

R314.4.1 Heat detection interconnection. Heat detection devices shall be connected to an alarm or a smoke alarm that is installed in the dwelling. Alarms and smoke alarms that are installed for this purpose shall be located in a hallway, room, or other location that will provide occupant notification.

R314.6 Power source. Smoke alarms and heat detection devices shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

Commenter's Reason: The original code change proposal contained fire data from NFPA's Home Structure Fires research report. A commenter questioned this data, stating that it should be taken with a grain of salt. The individual stated that the data relates to all existing homes and that the data does not reflect the age of the home. This comment is irrelevant because fire does not discriminate. New garages do not contain any less combustible material than they did in the past. In fact, they may contain more, such as volatile lithium-ion batteries and energy storage systems.

A comment was made which stated that older homes don't have sheetrock separation between the home and the attached garage. This is not true. There are many older homes that do have sheet rock separation. More importantly, this argument is also irrelevant. What must be understood is that fire separation between an attached garage and a dwelling only allows the fire to burn for a longer period of time before it is detected. During this period, the fire grows larger, hotter, and more difficult to control. This is the reason that garage fires cause greater damage. The way that garage fires are detected may be summed up in one of three ways:

1. A neighbor or passerby notices the fire,
2. The fire burns through the garage/dwelling separation and ignites the home, or
3. The homeowner detects the fire (audible, heat, and/or smoke).

Unfortunately, homeowners do not always detect the fire, especially when they are asleep. Placing a heat detector in this unprotected area of a home will provide a level of protection that does not currently exist. Fire separation between a dwelling and an attached garage may only provide a false sense of security. Even FEMA recommends the installation of a heat detector to "*aid in the early detection of garage fires*".

<https://www.usfa.fema.gov/downloads/pdf/statistics/v14i12.pdf>

A comment was made stating that manufactures don't have devices that are listed for high temperatures and further stated that the backup batteries are only listed for up to 130° F. There are many devices that are rated for high temperatures because these devices are intended to be installed in areas where fire occurs. For example, First Alert, System Sensor, and Kiddie manufacture devices that will meet the needs of this proposal.

There are many different models of heat detectors to choose from. More importantly, there are many different ways to integrate a heat detector into a smoke detection system, a smoke alarm, or notification appliance. The code change proposal addresses this diversity by stating "*Heat detection shall be listed to UL 521 or UL 539, as appropriate for the intended application.*"

A committee member stated that "*There are several problems with the proposed text. Instead of referring to temperature and humidity, why not just refer to outdoor use?*" This recommendation does not work because the devices are not rated for outdoor use. The devices are rated for indoor

use and for temperatures that approach ambient outdoor temperatures.

A committee member stated that “*There is already effective prescriptive fire protection for this in the code*”. There is not effective prescriptive fire protection for garage fires in the code, which is the sole reason for this proposal. The difference between fire separation and fire detection in this case is that separation allows the garage and its contents to burn for a predetermined period of time before allowing the fire to spread to the attached home. In contrast, a heat detector will provide occupant notification before the fire spreads to the home. This code change proposal is intended to address a well-documented hazard that is not adequately addressed by the code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

- For a new home with a new attached garage, an interconnected heat detection device will increase the cost of construction by about \$100, which includes installation.
- If a new garage is attached to an existing dwelling which only has battery powered smoke alarms installed, the heat detection device will require the installation of an interconnected alarm or smoke alarm to be installed in the dwelling for the purposes of providing occupant notification. Under this scenario, the total cost will increase to about \$200.

Public Comment# 1999

RB129-19

IRC@: R314.3.1 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.
4. Smoke alarms listed and marked "helps reduce cooking nuisance alarms" shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking appliance.

Reason: This proposal recognizes that smoke alarms listed to the new edition of UL 217 (with an effective date of May 29, 2020) are required to pass tests designed to reduce nuisance alarms caused by residential cooking. The proposal provides an additional option for the types of smoke alarms that can be used near cooking appliances, without changing additional options.

The wording is based on the following 2019 NFPA 72 language:

29.11.3.4 (6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 ft (1.8 m) and 20 ft (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be listed for resistance to common nuisance sources from cooking.

There is no need to reference the 2022 effective date in NFPA 72 because if smoke alarms are listed to the new requirements prior to that date they should be allowed to be used as an option to the other technologies provided in Items 1 to 3.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac>.

Cost Impact: The code change proposal will increase the cost of construction

The increased cost will be for providing carbon monoxide detection when classrooms in Group E occupancies are covered by these code sections.

RB129-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This proposal is consistent with UL 217, 8th edition, which requires that these alarms be identified as cooking nuisance resistant. (Vote: 10-1)

Assembly Action:

None

RB129-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R314.3.1 (New)

Proponents:

Micah Chappell, representing Seattle Department of Construction and Inspections (micah.chappell@seattle.gov); Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.
4. Smoke alarms listed ~~and marked "helps reduce cooking nuisance alarms"~~ in accordance with NFPA 72 for resistance to common nuisance sources shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking appliance.

Commenter's Reason:

There is no requirement in NFPA 72 for smoke alarm devices to be **marked** "helps reduce cooking nuisance alarms". The devices are only required to be **listed** for resistance to common nuisance sources from cooking:

*NFPA 72 29.11.3.4 (6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 ft (1.8 m) and 20 ft (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be **listed** for resistance to common nuisance sources from cooking.*

This PC addresses what is actually required by NFPA 72 by removing the unneeded requirement for manufacturers to mark the devices.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The PC decreases the cost of the proposed code change. Removing the requirement for smoke alarms to be marked with the nuisance alarm language found in NFPA 72 decreases the cost of the original code change proposal to manufacturers.

RB131-19

IRC@: R316.2.1 (New), R316.3

Proposed Change as Submitted

Proponents: David Rich, Reax Engineering, representing Reax Engineering Inc. (rich@reaxengineering.com); Joe Charbonnet, representing Green Science Policy Institute (joe@greensciencepolicy.org); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, DCAT, representing DCAT (strawnet@gmail.com); Arlene Blum, representing Green Science Policy Institute (arleneb@lmi.net); Donald Lucas, representing Self (dlucas0929@gmail.com); Suzanne Drake, representing PERKINS+WILL (suzanne.drake@perkinswill.com); Marjorie Smith, representing Siegel & Strain Architects (msmith@siegelstrain.com); Paul Wermer, representing self (paul@pw-sc.com); Michael Lipsett, representing Self (mlipsett@astound.net); Alicia Daniels Uhlig, representing International Living Future Institute (alicia.uhlig@living-future.org); William Kelley, County of Marin, representing County of Marin and County Building Officials Association of California (CBOAC); Tony Stefani, representing San Francisco Firefighters Cancer Prevention Foundation (stefanit@sbcglobal.net); Clark Rendall, representing Troon Pacific (cpr@troonpacific.com); Vytenis Babrauskas, representing Fire Science and Technology Inc. (vytob@doctorfire.com); Joseph Fleming, Boston Fire Dept., representing Boston Fire Dept.; Teresa McGrath, representing Healthy Building Network (tmcgrath@healthybuilding.net); Alison Mears, Parsons The New School, representing Healthy Materials Lab (mearsa@newschool.edu); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Residential Code

Add new text as follows:

R316.2.1 Mark on polystyrene foam insulation without flame retardants. Polystyrene foam insulation boards manufactured without flame retardants shall be marked in accordance with this section.

1. Each board shall be marked on both faces every 8 square feet in red 1/2" text with the following information:

- WARNING - FIRE HAZARD
- This product must only be installed below a minimum 3.5-inch thick concrete slab on grade.
- NOT FOR VERTICAL OR ABOVE GRADE APPLICATIONS
- This product contains NO flame retardants
- Not tested for flame spread or smoke development requirements of the model building codes

2. Each package shall be marked on at least two sides in red 1/2" text with the following information:

- WARNING – COMBUSTIBLE MATERIAL
- Keep away from ignition sources
- Maintain code required separation between product storage and structures under construction (minimum 30 feet).

Revise as follows:

R316.3 Surface burning characteristics. Unless otherwise allowed in Section R316.5, foam plastic, or foam plastic cores used as a component in manufactured assemblies, used in building construction shall have a flame spread index of not more than 75 and shall have a smoke-developed index of not more than 450 when tested in the maximum thickness and density intended for use in accordance with ASTM E84 or UL 723. Loose-fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

Exception Exceptions:

1. Foam plastic insulation more than 4 inches (102 mm) thick shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested at a thickness of not more than 4 inches (102 mm), provided that the end use is *approved* in accordance with Section R316.6 using the thickness and density intended for use.

2. Polystyrene foam insulation boards with a maximum thickness of 2 inches (51 mm) where installed below a minimum 3.5-inch (89 mm) thick concrete slab-on-grade.

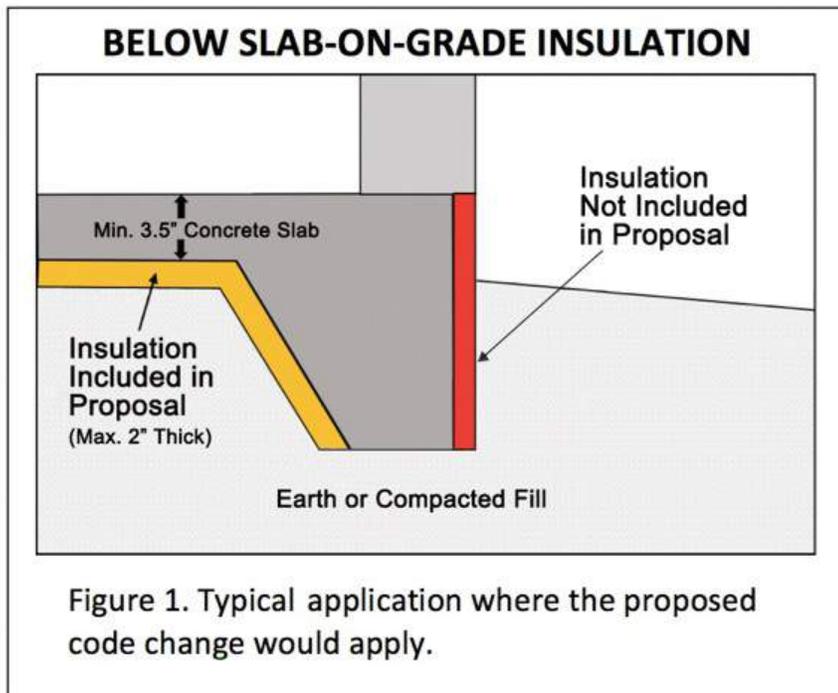
Reason: Purpose of Proposal

Polystyrene insulation (EPS and XPS) is commonly used in buildings to improve energy efficiency. To meet fire test building code requirements in the US and Canada all such insulation currently must contain flame retardant chemicals. In many cases, the tests do not accurately assess the fire safety of insulation.¹ Research has shown that flame retardants used in polystyrene insulation below a slab-on-grade do not provide a significant fire-safety benefit. However, across their lifecycle these chemicals can harm human and ecosystem health.²

This code change proposal would allow, but not require, the use of polystyrene insulation without flame retardants when installed below a concrete slab-on-grade at least 3-1/2 inches thick. The proposal was developed in response to the demand for healthier building materials from designers, developers and builders.

This proposed code change is nearly identical to the code change developed and advanced by the California Office of the State Fire Marshal for

both the California Residential and the California Building Codes.



Justification for Proposal

Academic research and expert opinion that flame retardants are unnecessary for insulation below a slab-on-grade.^{1,3} Neither an ignition source nor sufficient oxygen are present below a concrete slab-on-grade to support combustion. This proposal stipulates that flame retardant-free insulation and packaging be labeled with red 1/2" text lettering to ensure safe transport, storage, and proper installation.

Flammable liquids and gases, engineered wood products, and ABS pipe are all commonplace on construction sites. Other flame retardant-free polystyrene products such as cups and plates, packaging, and ice chests are stored and transported safely. Existing fire safety requirements in the fire and building codes, and in transportation regulations, adequately address necessary design and safety precautions for flame retardant-free polystyrene insulation.

Through the process described below, the California Office of the State Fire Marshal determined that chemical flame retardants provide no fire safety benefit for polystyrene insulation below a concrete slab-on-grade.

On the other hand, considerable peer-reviewed research has found that flame retardants used in building insulation are harmful to human and ecosystem health.^{4,5} Flame retardants have been linked to neurological impairment, hormone disruption, and aquatic toxicity.⁶⁻⁸ The flame retardant currently used in polystyrene insulation, PolyFR, is a brominated chemical that has not been well-studied nor proven safe.^{4,9} The manufacture, installation, demolition, landfilling, incineration, and recycling of flame-retarded polystyrene insulation can lead to environmental release of flame retardants and their toxic combustion by-products including brominated dioxins and furans. These chemicals can harm the health of construction workers and others exposed throughout the product life-cycle.

Human and ecosystem health and safety are within the ICC's scope of concern. The language of intent of the 2018 IRC in Section R102.3 states: "The purpose of this code is...to safeguard the public safety, health and general welfare...from...hazards attributed to the built environment."¹⁰ Action has been taken in ICC codes to limit exposure to lead, carbon monoxide, ozone depleting substances, volatile organic compounds, toxic compounds, and formaldehyde based on scientific evidence demonstrating that these materials present human health and environmental hazards.¹⁰⁻¹³

History of Proposal Development

The California Office of the State Fire Marshal developed the language in this IRC proposal in collaboration with a large, multi-stakeholder Working Group on flammability standards for building insulation materials from 2014-2016. The Working Group recommended testing to determine the fire safety benefit of adding flame retardants to polystyrene insulation below a slab-on-grade.¹⁴

The Office of the State Fire Marshal commissioned Oklahoma State University (OSU) to compare the flammability of polystyrene insulation in a subgrade installation with and without flame retardants. The CAL Fire/OSU Phase II Working Group reviewed and provided input on the testing criteria and results. Members of the Working Group representing multiple stakeholder perspectives were present for the testing. This group included

scientists, NGOs, and representatives of flame-retardant manufacturers. Standard testing protocols had not been previously developed for combustible materials below a concrete slab-on-grade due to a lack of fire hazard in this application. Therefore, the Working Group, in collaboration with the OSU researchers, developed the specific tests and testing configurations.

The OSU researchers found:¹⁵

- When installed below-slab, insulation without flame retardants presents no risk of fire spread to the building and will not endanger occupants or first responders.
- Adding flame retardants to polystyrene insulation does not significantly reduce peak heat release rates.
- The time to ignition of flame-retardant free polystyrene was comparable to other combustible materials commonly found at construction sites.

The Phase II report can be found at: http://osfm.fire.ca.gov/codedevelopment/pdf/CalFire-OSU_Phase_II_Working_Group_Final_Report.pdf

Based on the result of the independent testing and following review by the California Building Standards Commission's Code Advisory Committee and public comment, the Office of the State Fire Marshal proposed code changes to the California Building Standards Commission which are technically identical to this proposal for the IRC.

In summary, the California Office of the State Fire Marshal concluded, based on extensive stakeholder input, prior research, and transparent and independent testing by OSU, that flame retardant-free polystyrene foam insulation below slab-on-grade presents no fire risk, and the addition of flame retardants provides no fire-safety benefit. Flame retardant-free polystyrene insulation boards would create no more of a fire hazard than other combustible materials commonly found on construction sites, existing codes and standards that cover fire safety during construction.

Precedent in Scandinavian countries

Code updates in Norway have allowed polystyrene insulation board without flame retardants in buildings. A report by the Norwegian government in 2011 stated insulation placed underneath the concrete slab is considered to be the most fire safe solution. In the finished foundation, the insulation material is well protected from fire exposure. There is no advantage of using fire resistant materials or materials with flame retardants in this construction."

Similarly, a Risk Management Evaluation for EPS and XPS foam insulation stated: "By using thermal barriers it is possible to fulfill fire safety requirements in most uses in construction and buildings with EPS and XPS without a fire retardant do not represent a higher cost to the manufacturer. Our research of available data from these countries found no evidence of increased fire risk, insulation fires, or rollbacks of these code changes.^{18,19} Thus, this proposed code change has a significant precedent without increased fire risk.

Summary Statement

The proponents urge you to support this common-sense proposal. Human and ecosystem health will be improved. Fire fighters, building officials, and architects agree that builders should be able to choose flame retardant-free polystyrene insulation below a slab-on-grade.

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Cost Impact: The code change proposal will not increase or decrease the cost of construction because this code change is not mandatory, there would be no required increased or decreased costs.

RB131-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: In Section R316.2.1, now building inspectors will have to check labels on site, which will add to their workload. There is a challenge with combustible items in general. NFPA 241 is not in the residential code. R316.3 does not seem to be a problem. Insulation under 3 1/2 inches of concrete shouldn't be a problem.

There is some redundant language in the warning label. Saying it must be installed below 3 1/2 inches of concrete only, and then not for vertical applications, is redundant. The 30 foot requirement comes from NFPA 241, but that is not referenced in the IRC. "Model building code" is written on the test label. Which model building code? Be specific and say IRC if that's what you mean. The labeling is getting there but is not there yet.

It appears that foam might be able to be used under the slab under the current code text.

Some labeling criteria is not relevant for the building inspector. The toxicity and chemical issues are outside the scope of the IRC. OSHA, EPA and the federal government might be the appropriate agencies to deal with that. The labeling language is flawed. The building officials are not the right agents to enforce this. The labeling hampers what this proposal is trying to accomplish. This is a real issue. There needs to be collaboration with industry to find a way to address this issue. We are losing firefighters. We need to pull together firefighters, academia, research, manufacturers and suppliers. But this argument shouldn't be happening in the code arena. It should be happening in the research area. To many of our friends are dying.

(Vote: 10-1)

Assembly Action:

None

RB131-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R316.2.1 (New)

Proponents:

David Rich, Reax Engineering, representing Reax Engineering Inc. (rich@reaxengineering.com); Joe Charbonnet, representing Green Science Policy Institute (joe@greensciencepolicy.org); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Donald Lucas, representing Self (dlucas0929@gmail.com); Suzanne Drake, representing WRNS Studio (sdrake@wrnsstudio.com); Ron Flax, Boulder County, representing Self (rflax@bouldercounty.org); David Collins, representing The Preview Group, Inc. (dcollins@preview-group.com); Steven Winkel, representing American Institute of Architects (swinkel@preview-group.com); William Kelley, Marin County Community Development Agency, representing Marin County Community Development Agency (bkelley@marincounty.org); Racquel Segall, representing International Association of Fire Fighters (rsegall@iaff.org); Tony Stefani, representing San Francisco Firefighters

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R316.2.1 Mark on polystyrene foam insulation ~~without flame retardants, not meeting R316.3 Surface burning characteristics.~~ Polystyrene foam insulation boards ~~manufactured without flame retardants, not meeting the surface burning characteristics requirements in Section R316.3~~ shall be marked in accordance with this section.

1. Each board shall be marked ~~on both faces every 8 square feet in red 1/2" text with the following information:~~ across both faces with 2-inch (51 mm) wide red stripes separated 6 inches (152 mm) from each other, and with text not less than 1/2 inch (13 mm) high, spaced so that no point on the board is more than 18 inches (457 mm) from text with the following information:

- ~~WARNING—FIRE HAZARD~~
- ~~This product must only be installed below a minimum 3.5-inch thick concrete slab on grade.~~
- ~~NOT FOR VERTICAL OR ABOVE-GRADE APPLICATIONS~~
- ~~This product contains NO flame retardants~~
- ~~Not tested for flame spread or smoke development requirements of the model building codes~~
- CAUTION: Combustible. Do not expose to flame or ignition sources.
- Install only below a minimum 3.5-inch thick concrete slab on grade.
- Store and use in accordance with applicable building codes.

2. Each package shall be marked ~~on at least two sides in red 1/2" text, across not less than four sides with 2-inch (51 mm) wide red stripes separated 6 inches (152 mm) from each other, and with text not less than 1/2-inch (13 mm) high~~ with the following information:

- ~~WARNING—COMBUSTIBLE MATERIAL~~
- ~~Keep away from ignition sources~~
- ~~Maintain code required separation between product storage and structures under construction (minimum 30 feet).~~
- CAUTION: Combustible. Do not expose to flame or ignition sources.
- Install only below a minimum 3.5-inch thick concrete slab on grade.
- Store and use in accordance with applicable building codes.

Commenter's Reason:

RB131-19 allows builders the choice to use flame retardant-free EPS and XPS insulation beneath a concrete slab on grade.

The committee supported allowing a healthier product with a market demand and a history of safe use in Europe. The committee voted for disapproval largely over concerns with the marking of flame retardant-free insulation. Some committee members were also concerned that identification of this material would be unclear or pose a burden on building officials.

This modification addresses the major objections from the committee regarding marking language, inspection, and potential misuse. The marking language has been simplified and aligned with industry standards for foam insulation products.

The proposed marking provisions in R316.1 have been revised.

- Red striping is required on flame retardant-free insulation boards. With the required text, this mark will make these boards readily identifiable. This modification will minimize both the potential for misapplication and the burden to inspectors.
- Redundant language and references to the "model building code" were removed.
- Required frequency of marking text is defined in a manner consistent with existing IRC language (e.g., E3091.2.1).
- The California Association of Building Officials (CBOAC) were co-proponents of the proposal, indicating their belief that the required marking facilitates inspection.

Applicable standards exist for construction sites.

- The committee expressed concern about NFPA 241, which regulates material spacing on work sites, not being in the code.
- The reference to the NFPA 241 spacing requirement has been removed, maintaining the IRC as a stand-alone code. Worksite-related marking refers to "applicable building codes," as is standard for insulation products.
- Construction sites are generally beyond the purview of the IRC and well-regulated by other codes.

The proposed change is necessary to use flame retardant-free EPS/XPS insulation.

- The present code requires all foam plastic insulation to meet the flame spread and smoke development requirements in R316.3. Without Exception 2 for below-slab applications, foam plastic insulation products without flame retardants cannot be used.
- Committee members agreed there was no fire safety hazard in this application, stating, "Insulation under 3-1/2 inches of concrete shouldn't be a problem."

This proposal is within the scope of the IRC.

- The International Association of Fire Fighters support this proposal to reduce the unnecessary use of flame retardants which could harm their health.
- When there is no fire safety benefit (as is the case for flame retardants in below-slab insulation) there is no rationale for a requirement leading to the use of flame retardants.
- The language of intent of the IRC states: "The purpose of this code is...to safeguard the public safety, health and general welfare...from...hazards attributed to the built environment." I-codes limit exposure to other toxics based on evidence that materials present health hazards.

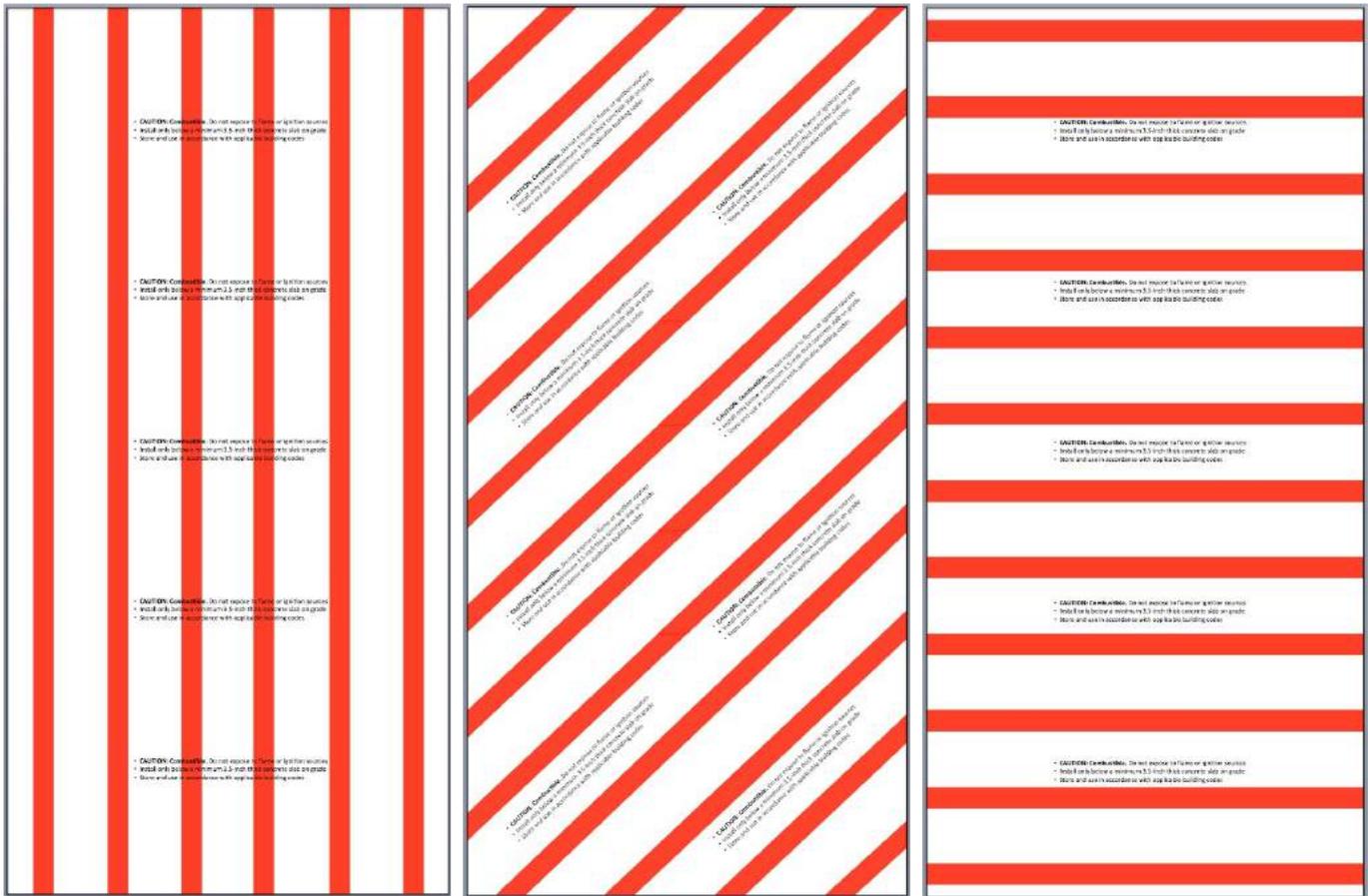


Figure. Examples of to-scale marking layouts on a 4-foot by 8-foot insulation board that comply with this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Because this code change is not mandatory, there would be no required increased or decreased costs.

Public Comment 2:

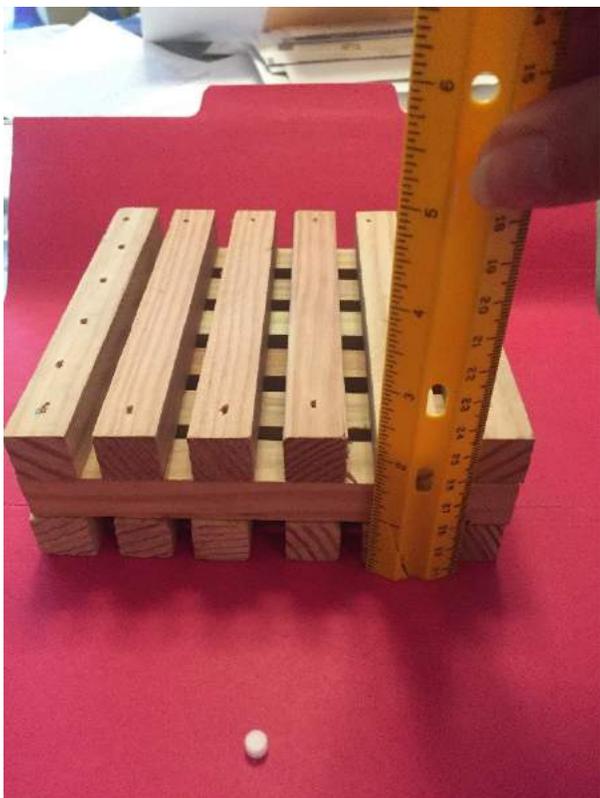
Proponents:

Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

requests Disapprove

Commenter's Reason: The basic reason that I, Marcelo M. Hirschler, request continued disapproval of this proposal is that the proposed change will decrease fire safety. The following details are based on the flawed Oklahoma State University (OSU) report commissioned by the California State Fire Marshal.

1. The OSU project demonstrated that fire retarded EPS (expanded polystyrene) foam was much less easily ignited than non-fire retarded expanded polystyrene (Non-FR EPS) foam.
2. The difference in ignition performance found by the OSU project was not minimal but very substantial. In detail, the ignition source in ASTM D2859 (which ignited the Non-FR EPS foam) is a methenamine pill that weighs 150 mg and has the approximate size of a shirt button (meaning that about 200 pills weigh an ounce) while the Class B ignition source from ASTM E108 (which was needed to ignite the FR EPS) is solid wood that weights 500 g (over a pound). There is no realistic comparison between the ease of ignition of the FR EPS foam and the Non-FR EPS foam. The photograph below has the methenamine pill on the left (in white) and the Class B ignition source (wood) on the right. The picture below that shows the two ignition sources from a different angle. The picture below that shows a bottle of methenamine pill ignition sources,





3. The ASTM D2859 test (also known as 16 CFR 1630) is the minimal fire test that any carpets and rugs sold in the US are required to meet, as mandated by the federal government and regulated by CPSC. It is an irrelevant test for anything else and it is amazing that a product that fails that test is proposed for use.

4. The difference in flame spread resulting from applying the methenamine pill to FR EPS foam and Non-FR EPS foam is astounding, as shown in Figure 9 of the OSU report: while very little happened to the FR foam, the non Fr foam burnt completely. The picture below shows the flame spread by the two foams, with the Non-FR one on the left.

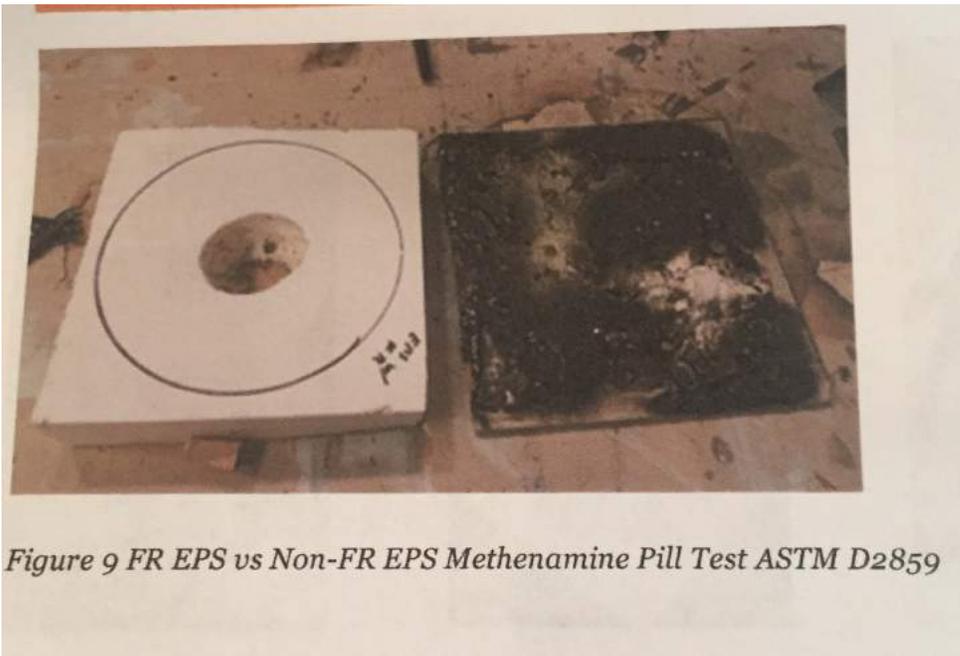


Figure 9 FR EPS vs Non-FR EPS Methenamine Pill Test ASTM D2859

5. The OSU project developed a very arbitrary classification of fire risk that is not in compliance with any standard definition of fire risk (which is defined in ASTM E176 (Standard Terminology of Fire Standards) as “an estimation of expected fire loss that combines the potential for harm in various fire scenarios that can occur with the probabilities of occurrence of those scenarios”). Fire risk assessment must follow the guidance of ASTM E1776 (Standard Guide for Development of Fire-Risk-Assessment Standards) but no such analysis was made by OSU.

6. Assuming that the OSU fire risk classification is acceptable, one aspect of the classification is that it shows that Non-FR EPS has a higher fire risk than FR EPS.
7. A further result of the OSU classification is, interestingly, that Non-FR EPS also has a higher fire risk than both FR polyethylene sheet and Non-FR polyethylene sheet. That means that Non-FR EPS has a higher fire risk than a product that the CA Fire Chiefs believe is unsafe and that they have required to be deleted from the International Fire Code (IFC). The IFC accepted a proposal that all tarpaulins used in construction must meet ASTM E84 Class A or exhibit a very low heat release, both fire properties that polyethylene sheets will not meet (independently of whether they are or not FR treated). If the CA code change is approved it introduces a product less fire safe than other products not permitted in construction.
8. The OSU project criticized the fire tests known as the oxygen index (or LOI, ASTM D2863) and the Steiner tunnel (or ASTM E84) but conducted no tests with either standard. However, the results from those maligned tests indicate the same as the OSU project results, and others: FR foam plastic exhibits better fire performance than Non-FR foam plastic (as evidenced by a higher oxygen index in ASTM D2863, a lower flame spread index in ASTM E84 and a lower heat release in heat release tests), and thus results in lower fire risk, something implicitly admitted in the report.
9. The OSU report did not measure heats of combustion and used book data, assuming that adding fire retardants does nothing to heat of combustion: that is incorrect. In fact, adding fire retardants will decrease the heat of combustion (and the heat release) as shown in a paper by Hirschler referenced by the report, but ignored ("Flame Retardants and Heat Release: Review of Traditional Studies on Products and on Groups of Polymers", M.M. Hirschler, Fire and Materials (Article published online, Fire and Materials, 03/11/2014, DOI: 10.1002/fam.2243), 2014).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1371

Public Comment 3:

Proponents:

Jay West, American Chemistry Council, representing Energy Efficient Foam Coalition (jay_west@americanchemistry.com)

requests Disapprove

Commenter's Reason: The Energy Efficient Foam Coalition (EEFC) supports the result of the Committee Action Hearing to disapprove RB 131-19. As noted multiple times in testimony, there are significant concerns around the potential misuse of non-flame retarded insulation when both listed (third party fire tested) and non-flame retarded (non-fire tested) foam insulation products are on the same job site. The unintended but foreseeable substitution of non-flame retarded insulation into other applications (such as installation on a vertical surface) would greatly enhance fire hazard.

In addition, RB 131-19 does not address the inherent risks and adequacy of existing fire protection schemes at manufacturing, storage, and retail facilities to protect flame retarded foam plastic insulation. We are not aware of any bulk storage testing of palletized non-flame retarded insulation board products, which could lead to unknown hazards in these facilities for customers, workers, and first-responders in the event of a fire. The presence of non-flame retarded foam plastic insulation bundles also creates a greater fire hazard when stored on the construction site prior to use. In the event of a fire, non-flame retarded insulation could create a fire that develops and spreads rapidly to other building materials.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1980

Public Comment 4:

Proponents:

John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

requests Disapprove

Commenter's Reason: XPSA supports the Committee action for disapproval for these reasons:

1. The RB131-19 proposal would permit any type of polystyrene foam insulation. But, the technically flawed Oklahoma State University (OSU) report, used to support this code change proposal, did not evaluate the fire performance of extruded polystyrene foam insulation (XPS) without flame retardant (non-FR).
2. The OSU fire test laboratory is not accredited by the International Accreditation Services (IAS).
3. The OSU fire test report on non-FR EPS demonstrates that non-FR EPS is a more significant fire hazard than the current code compliant flame retarded EPS insulation (FR EPS).
4. The Committee correctly pointed out that product composition or regulation of chemicals is not under the scope of the building code.
5. The US EPA has approved use of 3 flame retardants in both XPS and EPS (See: https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1964

RB139-19

IRC: 202 (New), R320.1, R320.1.1

Proposed Change as Submitted

Proponents: Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

2018 International Residential Code

SECTION R320 ACCESSIBILITY

Revise as follows:

R320.1 Scope. Where there are four or more *dwelling units* or sleeping units in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply. For the purpose of applying the requirements of Chapter 11 of the *International Building Code*, guestrooms shall be considered to be sleeping units.

Exceptions:

1. A *multistory dwelling unit* that is not provided with elevator service is not required to comply with this section.
2. Owner-occupied lodging houses with five or fewer guestrooms constructed in accordance with the *International Residential Code* are not required to comply with this section.

Delete without substitution:

~~**R320.1.1 Guestrooms:** A *dwelling* with guestrooms shall comply with the provisions of Chapter 11 of the *International Building Code* for Group R-3. For the purpose of applying the requirements of Chapter 11 of the *International Building Code*, guestrooms shall be considered to be sleeping units.~~

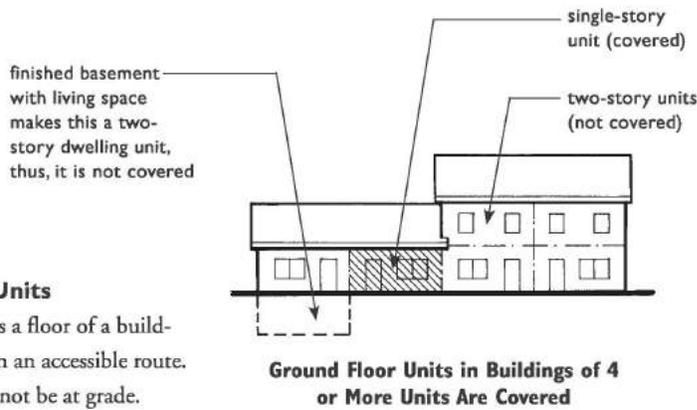
~~**Exception:** Owner-occupied lodging houses with five or fewer guestrooms constructed in accordance with the *International Residential Code* are not required to be accessible.~~

Add new definition as follows:

MULTISTORY UNIT. A *dwelling unit* or *sleeping unit* with *habitable space* located on more than one *story*.

Reason: Chapter 11 of the IBC exempts owner-occupied lodging houses with no more than five sleeping units and multistory dwelling units not provided with elevator service. IRC, Section 320 currently only mentions lodging houses being exempt. Therefore, this proposed amendment is intended to clarify, without the designer having to refer to both Section 320 of the IRC and Chapter 11 of the IBC, multistory dwelling units not provided with elevator service are not required to comply.

The following illustration from the Fair Housing Act Design Manual visually depicts which units are "covered" by the act, and which are "not covered." It also depicts the scope of Chapter 11 of the IBC and the intent of this amendment.



Bibliography: International Building Code, International Code Council, published in September 2018
 Fair Housing Act Design Manual, U.S. Department of Housing and Urban Development, published in August 1996, revised in April 1998.

Cost Impact: The code change proposal will decrease the cost of construction
 This proposal will decrease the cost of design and construction by eliminating potential misinterpretation and unnecessary regulation.

RB139-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: RB140-19 is preferred and conflicts with this proposal. (Vote: 8-3)

Assembly Action: **None**

RB139-19

Individual Consideration Agenda

Public Comment 1:

IRC@: 202 (New), R320.1

Proponents:

Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

MULTISTORY UNIT A dwelling unit or sleeping unit with habitable space located on more than one story.

R320.1 Scope. Where there are four or more *dwelling units* or sleeping units in a single structure, the provisions of Chapter 11 of the International Building Code for Group R-3 shall apply.

Exception: A multistory dwelling unit or sleeping unit that is not provided with elevator service is not required to comply with this section.

Commenter's Reason: The committee disapproved this proposal because of the overlap with RB140-19, however there is an distinct separate idea in RB139-19 that should move forward. IBC Section 1107.7.2 exempts multi-story townhouses without elevator service. Putting that exception in the IRC just eliminates a need to go to the IBC. This is similar to the exception already approved for lodging houses in RB140-19.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommitteebcac>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This matches existing allowances in the IBC for accessibility.

Public Comment# 1319

Public Comment 2:

Proponents:

Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

requests As Submitted

Commenter's Reason: The committee disapproved this proposal because of perceived conflict and overlap with RB140-19. However, each address distinctly different aspects of the code and the ideas in RB139-19 should move forward.

- Voting "yes" for RB139-19 would have zero effects on RB140-19, just as voting "yes" on RB140-19 would have zero effects on RB139-19. Furthermore, voting "yes" for both proposals would create a text that works seamlessly and applies both ideas to the code - clarity of the current multistory unit exemption and keeping up with the revised scope of the IRC.
- Structurally, both RB139-19 and RB140-19 edit "R320.1 Scope." identically and strike "R320.1.1 Guestrooms." in its entirety. The distinct differences lie in RB140-19's inclusion of a new section, "R320.2 Live/Work units." Which is irrelevant to RB139-19's intent to add a second exemption, "A multistory unit that is not provided with elevator service."
- Section 1107.7.2 of the IBC currently exempts multistory units without elevator service, therefore RB139-19 eliminates a need to reference the IBC. This is similar to the exemption currently offered in R320 for lodging houses, which is also still included in RB140-19.

Both RB139-19 and RB140-19 offer greatly needed improvements to the IRC without overlap or conflict. Therefore, the American Institute of Building Design encourages the approval of both proposals.

The following is an example of both RB139-19 and RB140-19 seamlessly entered into the text of the code without any modifications to either proposal.

R320.1 Scope. *Where there are four or more dwelling units or sleeping units in a single structure, the provisions of Chapter 11 of the International Building Code for Group R-3 shall apply. For the purpose of applying the requirements of Chapter 11 of the International Building Code, guestrooms shall be considered to be sleeping units.*

Exceptions:

1. *Owner-occupied lodging houses with five or fewer guestrooms constructed in accordance with the International Residential Code are not required to comply with this section.*
2. *A multistory dwelling unit that is not provided with elevator service is not required to comply with this section.*

R320.2 Live/work units. *In live/work units, the nonresidential portion shall be accessible in accordance with Sections 419.7 and 419.9 of the International Building Code. In a structure where there are four or more live/work units, the dwelling portion of the live/work unit shall comply with Section 1107.6.2.1 of the International Building Code.*

Add new definitions as follows:

LIVE/WORK UNIT. *A dwelling unit or sleeping unit in which a significant portion of the space includes a nonresidential use that is operated by the tenant.*

MULTISTORY UNIT. *A dwelling unit or sleeping unit with habitable space located on more than one story.*

SLEEPING UNIT. *A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.*

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost impact, the intent of the proposal is to provide clarification, only.

Public Comment# 1948

RB141-19

IRC®: R309.3, R322.1.6, R322.2.1, R322.2.2, R322.2.2.1, R322.3.2, R322.3.5, R322.3.6, R322.3.7

Proposed Change as Submitted

Proponents: Gregory Wilson, representing Federal Emergency Management Agency (gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, on behalf of Federal Emergency Management Agency, representing Federal Emergency Management Agency (rcquinn@earthlink.net)

2018 International Residential Code

Revise as follows:

R309.3 Flood hazard areas. For buildings located in flood hazard areas as established by Table R301.2(1), garage floors shall be one of the following:

1. Elevated to or above the ~~design flood~~ required lowest floor elevation as determined in accordance with Section R322.
2. Located below the ~~design flood~~ required lowest floor elevation provided that the floors are at or above *grade* on not less than one side, are used solely for parking, building access or storage, meet the requirements of Section R322 and are otherwise constructed in accordance with this code.

R322.1.6 Protection of mechanical, plumbing and electrical systems. Electrical systems, *equipment* and components; heating, ventilating, air-conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall be located at or above the elevation required in Section R322.2 or R322.3. If replaced as part of a substantial improvement, electrical systems, *equipment* and components; heating, ventilating, air-conditioning and plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall meet the requirements of this section. Systems, fixtures, and *equipment* and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: Locating electrical systems, *equipment* and components; heating, ventilating, air-conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* is permitted below the elevation required in Section R322.2 or R322.3 provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the ~~design flood~~ required elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided that they conform to the provisions of the electrical part of this code for wet locations.

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.

Exception: Enclosed areas below the ~~design flood~~ elevation required in this section, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

R322.2.2 Enclosed area below ~~design flood~~ required elevation. Enclosed areas, including crawl spaces, that are below the ~~design flood~~ elevation required in Section R322.2.1 shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria and are installed in accordance with Section R322.2.2.1:
 - 2.1. The total net area of nonengineered openings shall be not less than 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area where the enclosed area is measured on the exterior of the enclosure walls, or the openings shall be designed as engineered openings and the *construction documents* shall include a statement by a registered *design professional* that the design of the openings will provide for equalization of hydrostatic flood forces on *exterior walls* by allowing for the automatic entry and exit of floodwaters as specified in Section 2.7.2.2 of ASCE 24.
 - 2.2. Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.
 - 2.3. The presence of louvers, blades, screens and faceplates or other covers and devices shall allow the automatic flow of floodwater into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

R322.2.2.1 Installation of openings. The walls of enclosed areas shall have openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area ~~below the design flood elevation~~, each area shall have openings.
2. The bottom of each opening shall be not more than 1 foot (305 mm) above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.
3. Openings shall be permitted to be installed in doors and windows; doors and windows without installed openings do not meet the requirements of this section.

R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
5. Walls and partitions enclosing areas below the ~~design flood elevation~~ required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

R322.3.5 Walls below ~~design flood required~~ elevation. Walls and partitions are permitted below the ~~elevated floor elevation~~ required in Section R322.3.2, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a registered *design professional* that:
 - 4.1. The walls and partitions below the ~~design flood required~~ elevation have been designed to collapse from a water load less than that which would occur during the base flood.
 - 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.
5. Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.

R322.3.6 Enclosed areas below ~~design flood required~~ elevation. Enclosed areas below the ~~design flood elevation~~ required in Section R322.3.2 shall be used solely for parking of vehicles, building access or storage.

R322.3.7 Stairways and ramps. Stairways and ramps that are located below the lowest floor elevations specified in Section R322.3.2 shall comply with one or more of the following:

1. Be designed and constructed with open or partially open risers and guards.
2. Stairways and ramps not part of the required means of egress shall be designed and constructed to break away during design flood conditions without causing damage to the building or structure, including foundation.
3. Be retractable, or able to be raised to or above the lowest floor elevation, provided that the ability to be retracted or raised prior to the onset of flooding is not contrary to the means of egress requirements of the code.
4. Be designed and constructed to resist flood loads and minimize transfer of flood loads to the building or structure, including foundation.

Areas below stairways and ramps shall not be enclosed with walls below the ~~design flood elevation~~ required in Section R322.3.2 unless such walls are constructed in accordance with Section R322.3.5.

Reason: The primary aspect of elevated homes in flood hazard areas that contributes to reducing damage is the elevation of the lowest floor (R322.2.1) or lowest horizontal structural member of the lowest floor in Zone V and Coastal A Zones (R322.3.2) relative to the base flood elevation. The higher the floor, the lower the risk (and the lower are NFIP flood insurance premiums). To ensure the same level of protection is applied to all

aspects of dwellings, Section R322.1.6 requires mechanical, plumbing and electrical equipment to be located at or above the required elevations, and R322.1.8 requires use of flood damage-resistant materials below the required elevations. This same level of protection should apply to enclosures and walls below the required elevations. Currently, the level of protection for enclosures and walls is at the design flood elevation, which may be lower than the lowest floor elevations required in R322.2.1 and R322.3.2.

This proposal is consistent with ASCE 24, in which each table specifying elevations refers not to the elevation of the flood, but the required elevation of the lowest floor (ow lowest horizontal structural member of the lowest floor). This proposal is consistent with the NFIP regulations which, in Section 60.3(c)(5) specifies.... "fully enclosed areas below the lowest floor..." and Section 60.3(e)(5) which specifies...."space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls ...".

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Most enclosures below elevated buildings in flood hazard areas are constructed with all elements required for enclosures applied below the elevated lowest floor, thus no change in cost of construction. There may be a slight increase in cost in those rare situations where someone determines the DFE/BFE and "precisely" applies the regulations up to that elevation rather than up to the actual elevation of the lowest floor.

RB141-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This takes out "design flood" and puts in "required elevation," but does not change technical requirements. The proposal is consistent with ASCE 24. (Vote: 7-4)

Assembly Action:

None

RB141-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R309.3, R322.2.1, R322.3.2

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R309.3 Flood hazard areas. ~~Garages and carports~~ For buildings located in flood hazard areas as established by Table R301.2(1) shall be constructed in accordance with Section R322. ~~garage floors shall be one of the following:~~

- ~~1. Elevated to or above the required lowest floor elevation as determined in accordance with Section R322.~~
- ~~2. Located below the required lowest floor elevation provided that the floors are at or above grade on not less than one side, are used solely for parking, building access or storage, meet the requirements of Section R322 and are otherwise constructed in accordance with this code.~~

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.

3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
4. Garage and carport floors shall comply with one of the following:
 - 4.1 They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.
 - 4.2 They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage.

Exception: Enclosed areas below the elevation required in this section, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. Garages used solely for parking, building access or storage, and carports, shall comply with Item 1, or shall be at or above grade on not less than one side and, if enclosed with walls, such walls shall comply with Item 6.
- ~~4~~3. The use of fill for structural support is prohibited.
- ~~5~~4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
- ~~6~~5. Walls and partitions enclosing areas below the elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

Commenter's Reason: The purpose of this public comment is to address potential confusion introduced by relating the location of a garage or carport floor to the lowest floor elevation determined in accordance with Section R322.

Garages and carports can be either attached in part or in whole to an adjacent dwelling or detached and completely independent of the dwelling. In all cases, they can be constructed such that the garage or carport floor or slab is at or above the elevation required by R322. The garage or carport floor may be elevated to the same level as the lowest floor of an attached or adjacent dwelling, or to another level that is still above the BFE+1 or DFE.

However, most garages and carports are only used for parking, building access or storage, and thus the floor of the garage or carport - generally a concrete slab on grade - is permitted by the NFIP to be below the BFE or DFE as long as the garage or carport floor is above grade on not less than one side. In this case, the key elevation in question is that of the finished grade around the carport or garage. There is no sense in relating the placement of the carport or garage slab to the lowest floor elevation of the adjacent house, which may be several feet higher and accessed up a set of steps or ramp.

Further, there appears to be no particular reason why flood elevation requirements for garages and carports are "parked" in Section R309, away from the rest of the flood resistant construction requirements. Hence, this comment relocates the elevation requirements to the appropriate sections of R322 (R322.2.1 for Zone A and R322.2.2 for Zone V/Coastal A Zone), leaving a pointer behind in R309. In doing so, this allows for rewriting the elevation requirements to be more clear, using the opportunity to parallel the standard elevation requirement (e.g. R322.2.1 Item 1) and the requirement based on surrounding grade (e.g. R322.2.1 Item 2). This also creates a similar construct to the way ASCE 24 Section 9.2 presents requirements for attached and detached garages and carports.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As noted in the proponent's original cost impact statement, the changes in RB141 would increase the cost of construction if a builder is using the DFE or BFE itself in applying enclosure requirements, rather than the actual lowest floor elevation which may be a few feet higher. The public comment could reduce the cost impact slightly by clarifying the requirements of the NFIP and IRC as they relate to where a garage or carport is allowed to be below the DFE or BFE+1.

Proposed Change as Submitted

Proponents: Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (Jeffrey.Hinderliter@dos.ny.gov); Gerard Hathaway, New York State Department of State, representing New York State Department of State (gerard.hathaway@dos.ny.gov)

2018 International Residential Code

Revise as follows:

R325.6 Habitable attic. A habitable attic shall ~~not be considered~~ to be a story above grade plane, ~~a story where complying with all of the following requirements:~~

- ~~1. The occupiable floor area is not less than 70 square feet (17 m²), in accordance with Section R304.~~
- ~~2. The occupiable floor area has a ceiling height in accordance with Section R305.~~
- ~~3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~
- ~~4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.~~

Reason: The topic of habitable attics in the International Residential Code was discussed at length in previous hearings. During our code development process in New York State (which is based on the I-Codes), we have realized that allowing a habitable level above the third story above grade plane that is not considered a “story”, creates both an inconsistency between the IRC and the IBC and a potential threat to the life and safety of occupants living in dwellings regulated under this code. This same change has been proposed to the New York State Uniform Building Code Council for consideration.

1. The current allowance for a “habitable attic” in the IRC creates an inconsistency within the I-Codes.

In its introduction, the IRC states the IRC is “fully compatible with all the International Codes® (I-Codes®) published by the International Code Council® (ICC)®, including the International Building Code®.” The IRC also states in the section entitled “Effective Use of the International Residential Code” the following:

“All buildings within the scope of the IRC are limited to three stories above grade plane. For example, a four-story single-family house would fall within the scope of the International Building Code® (IBC®), not the IRC.”

Traditionally, the scope of the Residential Code has been limited to three-stories. The IRC currently allows additional habitable spaces within one- and two-family dwellings and townhouses that enlarge the size of a dwelling while still considering it a “three-story”: a habitable attic and story below grade plane (a basement). With a habitable attic not considered a story, a dwelling can now have 5 habitable levels, which we believe conflicts with the scope and intent of the Residential Code. It should be noted that there is no limit to the area of a habitable attic. The occupiable floor area and ceiling height requirements in Items 1 and 2 of Section R325.6 are just minimums required for habitable space. For example, a modest footprint three story dwelling with a cape cod style roof, could easily accommodate two bedrooms and a bathroom on the fourth habitable level above grade plane. A larger estate size dwelling could have as much space on that fourth habitable attic level as a small ranch style house.

As justification for this position, consider that the 2015 International Building Code® Illustrated Handbooks contains the following definition of an attic:

ATTIC. *Several provisions apply to the attic area of a building, such as those relating to ventilation of the attic space. In order to fully clarify that portion of a building defined as an attic, Chapter 2 identifies an attic as that space between the ceiling beams at the top story and the roof rafters. An attic designation is appropriate only if the area is not considered occupiable. Where this area has a floor, it would be defined as a story. A common misuse of IBC terminology is the designation of a space as a habitable or occupiable attic. Such a designation is inappropriate insofar as once such a space is utilized for some degree of occupancy; it is no longer deemed an attic.*

(Source: “2015 International Building Code® Illustrated Handbook” by The International Code Council® (ICC®), Douglas W. Thornburg, AIA, C.B.O., John R. Henry, P.E. Published by McGraw-Hill Education. Accessed through Access Engineering, a service of McGraw-Hill Education)

While this handbook is not enforceable, it acts as a commentary on the IBC and provides guidance as to how the IBC views individual provisions and definitions. As stated above, the IBC considers a space an attic when it “is not considered occupiable”. When a space becomes “habitable or occupiable” it is considered a story in the IBC. Hence, a three story one-family dwelling with a habitable attic would be considered a four-story building in the IBC.

There appears to be a conflict between how the IBC and the IRC views the same space. This conflict is allowing the creation of a space under the IRC which would require additional safety measures if built under the IBC. The IBC currently does not have a definition for a “habitable attic” nor any provisions that would allow this space to not be considered a story. Historically, the I-Codes have treated an attic that is habitable as a story.

2. Allowing the creation of a habitable attic, but not considering it an additional story, is allowing a structure that potentially creates

unmitigated life-safety hazards.

The IRC currently restricts one- and two-family dwellings and townhouses to be three-stories above grade plane with an unlimited area. For comparison purposes, this is consistent with the R-3 occupancy classification of the IBC. The Tables 504.3 and 504.4 of the 2018 IBC limit the building heights on R-3 occupancies to 40 feet or three stories for buildings equipped with a NFPA 13D automatic sprinkler system and 60 feet or four-stories for buildings equipped with a NFPA 13R automatic sprinkler system, respectively. It is noted that these tables were updated in the 2018 version of the IBC by a Code Action Committee of the ICC to address the consistency of the IBC (Refer to Code Change Proposal G133-15).

For a three-story, one-family dwelling with habitable space in the attic, the maximum story height is limited to 11'-7" in both the IRC and the IBC. Using both a typical story height (8'-0" ceiling height with a 1'-0" structural space) and the maximum story height, the following figures illustrate some possible building heights that can be achieved. Along with this comparison, Table 1 highlights some life-safety features that would result when these structures are constructed under either the IRC or the IBC. It should also be noted that the code currently does not bring into consideration habitable attics that include dormers or various roof styles (such as a mansard roof) that could easily blur the lines of the current definitions and create spaces that appear to miss the intentions of the original code change proposal.

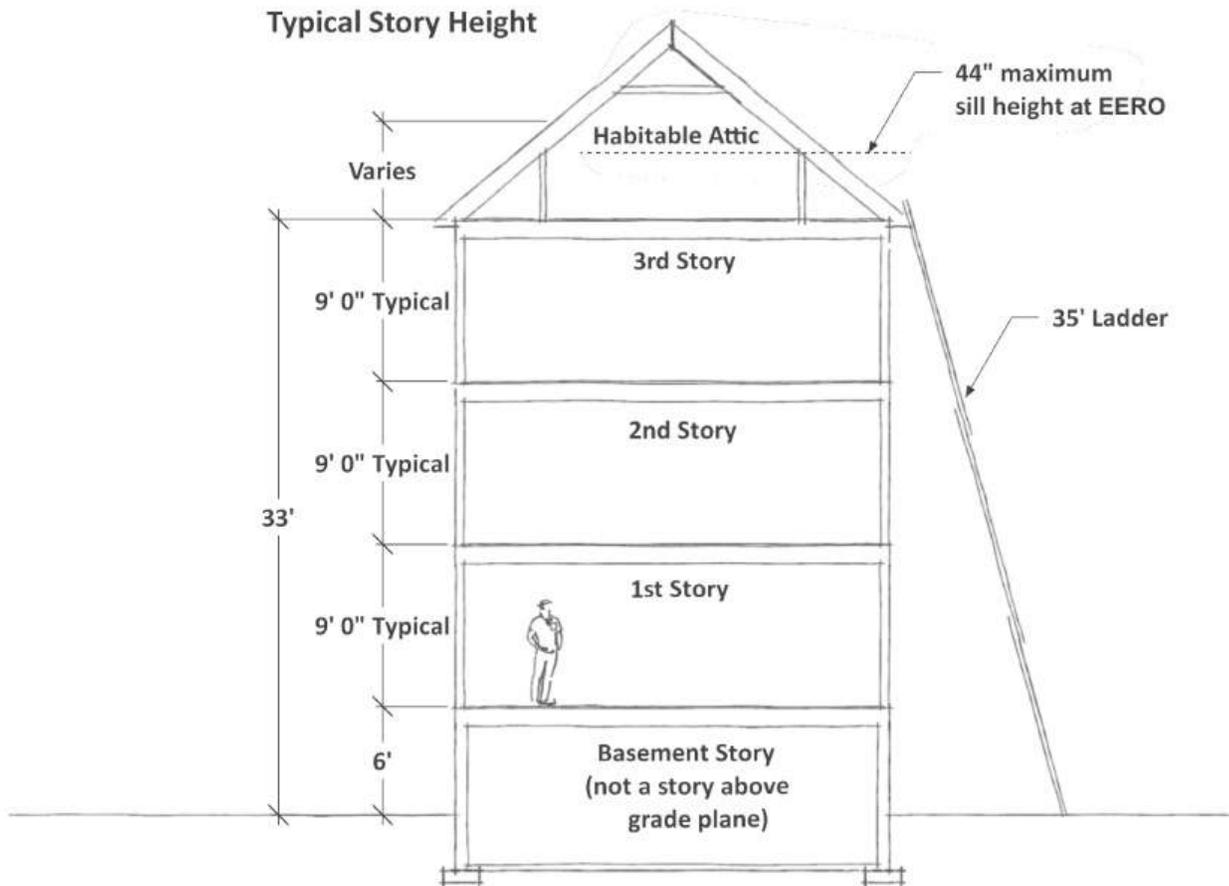


Figure 1

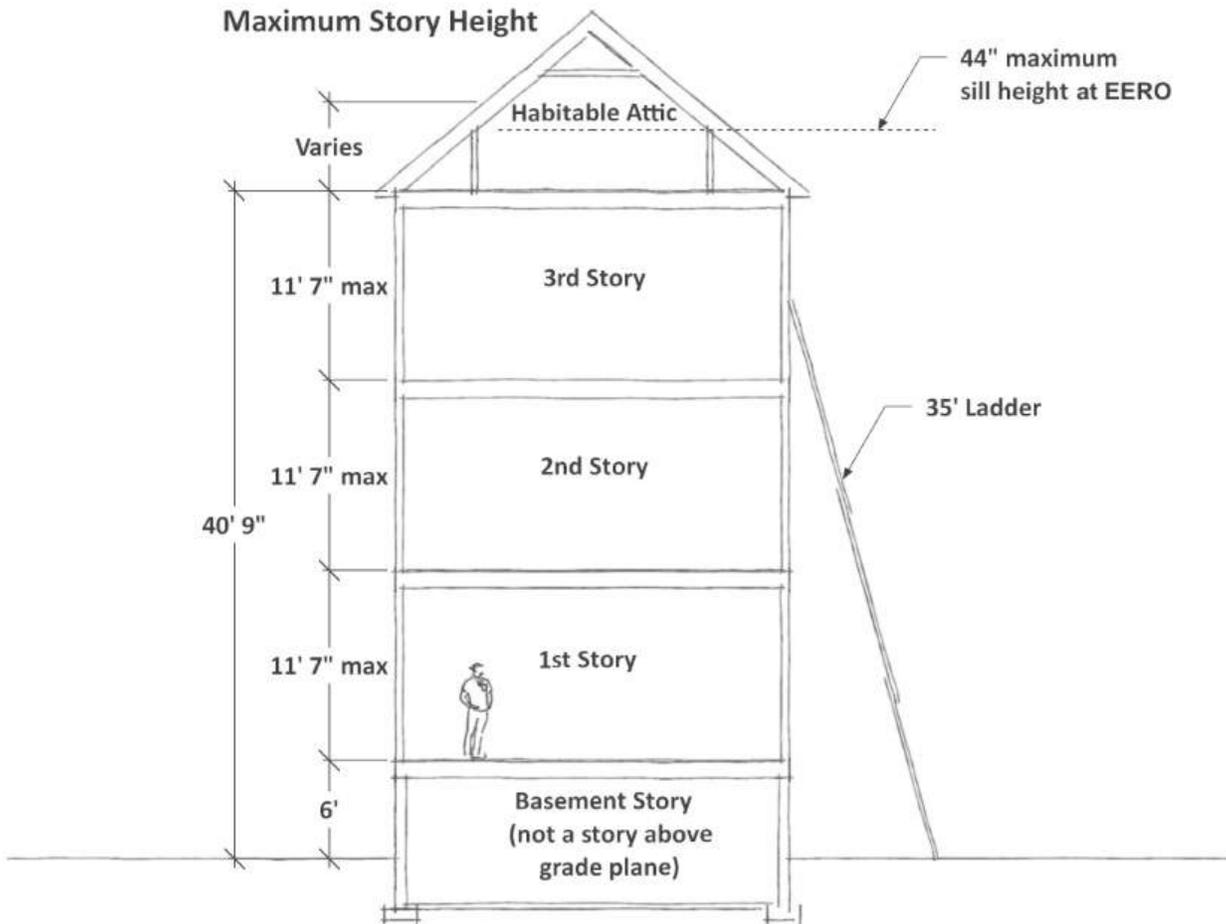


Figure 2

Table 1

Comparison of IRC Requirements to IBC Requirements for Figure 1 and Figure 2

IRC Requirements	IBC Requirements
One-Family Dwelling	Occupancy Group R-3
<ul style="list-style-type: none"> • 2018 IRC considers this a 3-Story Dwelling with a Habitable Attic • 2018 IRC Section R313.2 requires a Section P2904 or NFPA 13D sprinkler system, which results in a 10-minute sprinkler duration (P2904.5.2) • EERO required in the Habitable Attic (R310.1) • 35' ladder reaches 3rd story EERO, but may fail to reach the Habitable Attic (4th Level) EERO in Fig. 1, and fails to reach the Habitable Attic (4th Level) EERO in Fig. 2 	<ul style="list-style-type: none"> • 4-story Dwelling • IBC Table 504.4 would require a NFPA 13R sprinkler system, with a minimum 30-minute sprinkler duration for 4-stories (NFPA 13R Section 9.2) <p>o Alternative: Type IV or higher rated construction with an NFPA 13D system</p> <ul style="list-style-type: none"> • EERO not required above the 3rd story due to their ineffectiveness at that height (IBC Section 1030.1) • 35' ladder reaches 3rd story EERO, but may fail to reach the Habitable Attic (4th Level) EERO in Fig. 1, and fails to reach the Habitable Attic (4th Level) EERO in Fig. 2

As is shown in Table 1, the result of applying either the IRC or the IBC would result in different safety levels for the same structure.

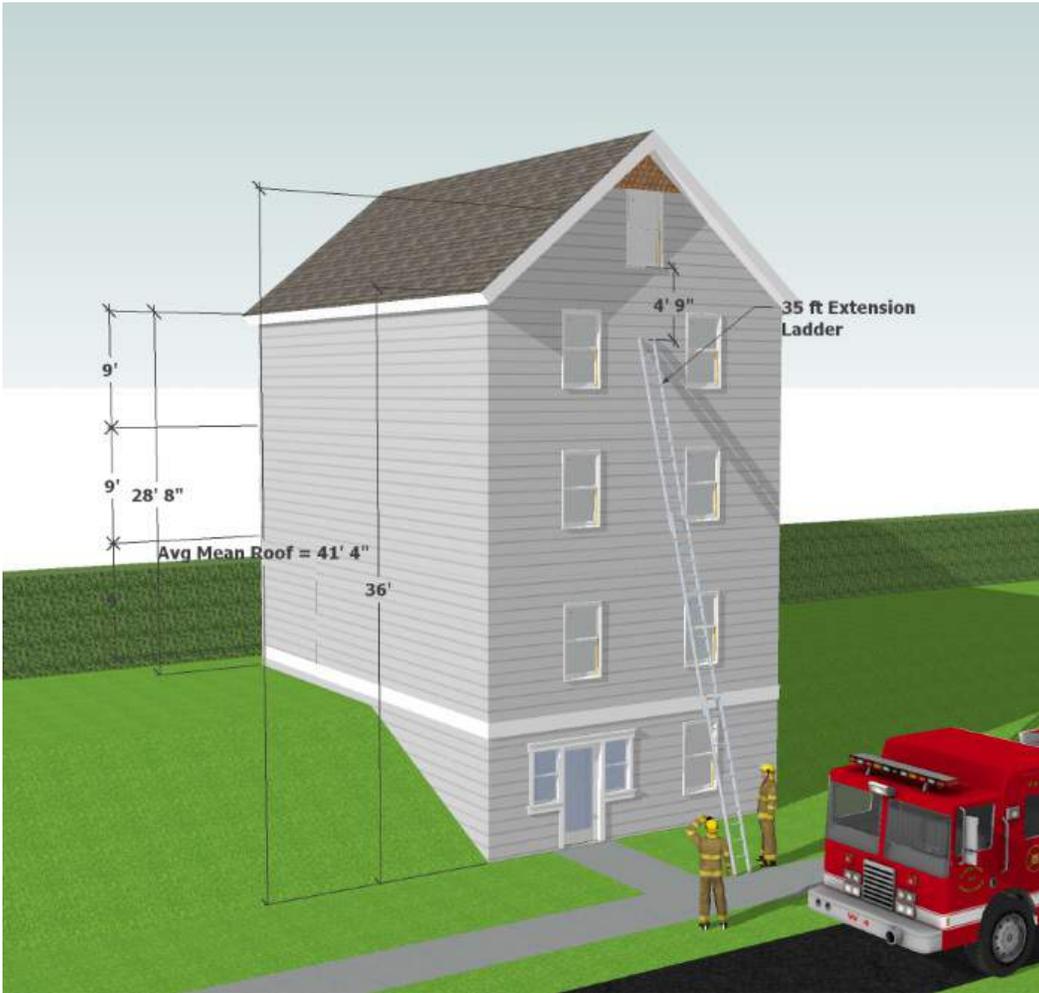


Figure 3: Walkout basement (not considered a story above grade plane) with typical story height, floor-to-floor, of 9'-0"

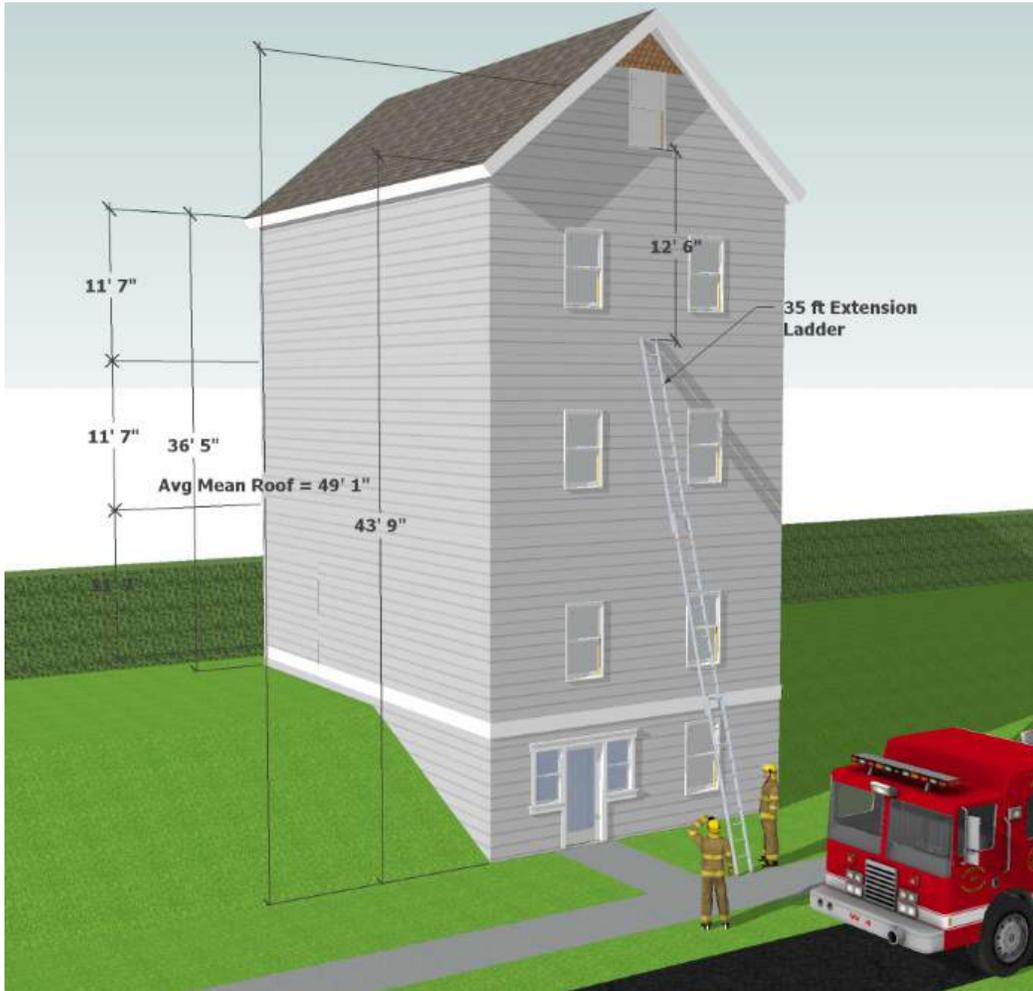


Figure 4: Walkout basement (not considered a story above grade plane) with maximum prescriptive story height, floor-to-floor, of 11'-7"

To correct this inconsistency, we recommend altering the IRC to consider a habitable attic a story above grade plane, as has been the historical interpretation of the IRC, and is the current practice of the IBC. The change would require new dwellings that exceed the three-story limit permitted under the IRC to be constructed to meet the structural and life-safety standards of the IBC. This will increase the safety of these tall dwellings and bring greater consistency across the I-Codes. We also recommend deleting the qualifying Items 1 through 4 because, once the habitable attic level is considered a story above grade plane, the qualifiers are not necessary.

We recommend the definition of, "Attic, Habitable" should remain unchanged because it differentiates that area of a building which contains "habitable space" from a typical "attic" as defined. The definition stating that a habitable attic can be finished or unfinished takes away the arguments made by those who would seek to disqualify the area in question because it is unfinished in some way. If the area is being used as habitable space, all other requirements necessary for a space to be considered habitable must be provided.

On the other hand, if the area is being used for non-habitable space such as for equipment or storage, then the owner should not be required to provide EEROs, egress stairs and other items required for habitable space, just because it has the minimum area and ceiling height requirements of a habitable space. Code enforcement officers could condition the Certificate of Occupancy for such a dwelling as a three-story structure with attic storage not approved for use as habitable space.

Bibliography: "2018 International Residential Code for one- and two-family dwellings" by The International Code Council® (ICC®). (2017). Country Club Hills, IL: International Code Council.

"2015 International Building Code® Illustrated Handbook" by The International Code Council® (ICC®), Douglas W. Thornburg, AIA, C.B.O., John R. Henry, P.E. Published by McGraw-Hill Education. Accessed through Access Engineering, a service of McGraw-Hill Education

Cost Impact: The code change proposal will increase the cost of construction

This code change, by returning to the historical interpretation and application of the IRC, would increase the cost of construction only when a habitable attic is above a third story, creating a fourth-story above grade plane. This change would potentially force some dwellings to be constructed under the IBC rather than the IRC, which would trigger height limitations and the need for higher types of construction and additional life-safety measures, including the potential to install a NFPA 13R system rather than a NFPA 13D system. This cost increase reflects the need to offset the increased risk of these structures.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is too restrictive. It should be acceptable on a 2 story house. All habitable attics should not be eliminated. (Vote: 8-3)

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IRC®: R325.6, R325.1, SECTION 326 (New), R326.1 (New), R326.2 (New), R326.3 (New), R326.4 (New)

Proponents:

Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~R325.6 Habitable attic. A habitable attic shall be considered to be a story above grade plane.~~

~~R325.1 General. Mezzanines shall comply with Sections R325 through R325.5. Habitable attics shall comply with Section R325.6.~~

~~R325.6 Habitable attic. A habitable attic shall not be considered a story where complying with all of the following requirements:~~

- ~~1. The occupiable floor area is not less than 70 square feet (17 m²), in accordance with Section R304.~~
- ~~2. The occupiable floor area has a ceiling height in accordance with Section R305.~~
- ~~3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~
- ~~4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.~~

SECTION 326 HABITABLE ATTICS

R326.1 General. Habitable attics shall comply with Sections R326.2 through R326.4.

R326.2 R326.2 Minimum Dimensions. A habitable attic shall have a floor area in accordance with R304 and a ceiling height in accordance with R305

R326.3 Story Above Grade Plane. A habitable attic shall be considered to be a story above grade plane.

Exception: A habitable attic shall not be considered to be a story above grade plane provided that the habitable attic meets all of the following:

1. The aggregate area of the habitable attic is not be greater than one-third of the floor area of the story below or is not be greater than one-half of the floor area of the story below where the habitable attic is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.

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2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.

3. The floor of the *habitable attic* does not extend beyond the exterior walls of the story below.

R326.4 Means of egress. The means of egress for *habitable attics* shall comply with the applicable provisions of Section R311

Commenter's Reason: We agree with the original proposal and most of the testimony given at the CAH with limiting the size, but still allowing some habitable attics to not be considered a story above grade plane.

This public comment finds a balance with the current specifications on habitable attics not being considered a story and limiting the size of habitable attics to address the life safety concerns indicated by the original proposal.

This public comment creates a new section for habitable attics, maintains and reorganizes the existing specifications for habitable attics, and includes a size limitation on habitable attics.

This public comment captures the issues identified by the Committee that they recommended for developing a public comment and addresses the various testimonies for and against the original proposal.

We have provided an attachment that shows how the Section should be formatted since cdpACCESS does not capture the correct formatting.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment would increase the cost of construction where habitable attics are large enough to be considered a story above grade plane.

Public Comment# 1490

Public Comment 2:

IRC@: R325.6, P2904.1.1

Proponents:

Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R325.6 Habitable attic. A habitable attic shall be considered to be a story above grade plane.

P2904.1.1 Required sprinkler locations. Sprinklers shall be installed to protect all areas of a *dwelling unit*.

Exceptions:

1. Uninhabitable attics, crawl spaces and normally unoccupied concealed spaces that do not contain fuel-fired appliances do not require sprinklers. In uninhabitable attics, crawl spaces and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be installed above the equipment; however, sprinklers shall not be required in the remainder of the space.
2. Clothes closets, linen closets and pantries not exceeding 24 square feet (2.2 m²) in area, with the smallest dimension not greater than 3 feet (915 mm) and having wall and ceiling surfaces of gypsum board.
3. Bathrooms not more than 55 square feet (5.1 m²) in area.
4. Garages; carports; exterior porches; unheated entry areas, such as mud rooms, that are adjacent to an exterior door; and similar areas.

Commenter's Reason: We agree with the original proposal and the testimony at the CAH to provide public comments addressing some concerns with the proposal. This public comment addresses one of the items left out of the original proposal by clearly identifying the type of attics where sprinklers are not required. When sprinklers are required in habitable spaces, habitable attics should be included since they are required to meet the habitable dimension requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment could increase the cost of construction since, if sprinklers are required, they would need to be installed in habitable attics.

Public Comment 3:

IRC@: R325.6, R325.1, SECTION R326 (New), R326.1 (New), R326.2 (New), R326.3 (New)

Proponents:

Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:**2018 International Residential Code**

~~R325.6 Habitable attic.~~ A habitable attic shall be considered to be a story above grade plane.

~~R325.1 General.~~ Mezzanines shall comply with Sections R325 through R325.5. ~~Habitable attics shall comply with Section R325.6.~~

~~R325.6 Habitable attic.~~ A habitable attic shall not be considered a story where complying with all of the following requirements:

- ~~1. The occupiable floor area is not less than 70 square feet (17 m²), in accordance with Section R304.~~
- ~~2. The occupiable floor area has a ceiling height in accordance with Section R305.~~
- ~~3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~
- ~~4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.~~

SECTION R326 **HABITABLE ATTICS**

R326.1 General. Habitable attics shall comply with Sections R326.2 and R326.3.

R326.2 Minimum Dimensions. A habitable attic shall have a floor area in accordance with Section R304 and a ceiling height in accordance with Section R305.

R326.3 Story Above Grade Plane. A habitable attic shall be considered a story above grade plane.

Exception: A habitable attic shall not be considered to be a story above grade plane provided that the habitable attic meets all the following:

1. The aggregate area of the habitable attic is
 - not greater than one-third of the floor area of the story below or
 - is not greater than one-half of the floor area of the story below where the habitable attic is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.
 -
2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
3. The floor of the habitable attic does not extend beyond the exterior walls of the story below.

Commenter's Reason: We agree with the original proposal and most of the testimony given a the CAH with limiting the size, but still allowing some habitable attics to not be considered a story above grade plane.

This public comment finds a balance with the current specifications on habitable attics not being a considered a story and limiting the size of habitable attics to address the life safety concerns indicated by the original proposal.

This public comment creates a new section for habitable attics, maintains and reorganizes the existing specifications for habitable attics, and includes a size limitation on habitable attics.

This public comment captures the issues identified by the Committee that they recommended for developing a public comment and addresses the various testimonies for and against the original proposal.

We have provided an attachment that shows how the Section should be formatted since cdpACCESS does not capture the correct formatting.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment would increase the cost of construction where habitable attics are large enough to be considered a story above grade plane.

Public Comment# 1558

Public Comment 4:

IRC®: R325.6

Proponents:

David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R325.6 Habitable attic. A habitable attic shall not be constructed above the ceiling of a third story above grade plane. A habitable attic shall not be considered to be a story above grade plane. to be a story where complying with all of the following :

1. The occupiable floor area is not less than 70 square feet (17 m²), in accordance with Section R304.
2. The occupiable floor area has a ceiling height in accordance with Section R305.
3. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.

Commenter's Reason: Original proposal has merit since a habitable attic within a third story essentially creates a fourth story which would otherwise not be allowed in the IRC - this creates a life safety issue as outlined in the original proposal. There were many concerns raised during the committee action hearings regarding calling a habitable attic a story and it was thought that calling a habitable attic a story is too restrictive since a habitable attic (that is not considered a story) should be allowed within a first or second story. This public comment keeps the 2015 IRC requirements for when a habitable attic is not a story, and adds a restriction that habitable attics are not allowed above the ceiling of a third story. This approach gets straight to the issue at hand and the intent of the original proposal, which is to not effectively create a four story building regulated by the IRC. If this restriction is not met, the project can still be constructed under the IBC with the attic being considered a story.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost of construction will increase only for projects that have a habitable attic within a third story above grade plane. These projects would have to be constructed in accordance with the IBC instead of the IRC, with cost increases as noted in the original proposal.

Public Comment# 1360

Public Comment 5:

IRC®: R325.6

Proponents:

Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R325.6 Habitable attic. A habitable attic shall not be considered a story where complying with all of the following requirements:

1. The occupiable floor area is not less than 70 square feet (17 m²), in accordance with Section R304.
2. The occupiable floor area has a ceiling height in accordance with Section R305.

3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.
4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.
5. Where a habitable attic is located above a third story, the dwelling unit or townhouse unit shall be equipped with a fire sprinkler system in accordance with Section P2904.

Commenter's Reason: Provisions allowing habitable attics were first included in the IRC in the 2009 edition (Proposal RB17-07/08). In the 2018 edition, the provisions were expanded to allow dormers to be included (Proposal RB166-16), eliminating the restriction that the ceiling of a habitable attic be limited to rafters/roof framing. Lacking restrictions on the height of knee walls or the size of dormers, the 2018 IRC essentially allows a habitable attic to be a "story" that's not counted as a story. When located above the third floor, there is no legitimate differentiation between a habitable attic and a fourth story, but the habitable attic allowance provides a "free pass" to stay in the IRC and avoid the three-story limit that ordinarily kicks you to the IBC.

In the 2009 IRC, when the habitable attic provisions were added to the code, the IRC also began requiring sprinklers. Therefore, the habitable attic allowance has, by default, always been associated with and contingent on sprinklers being provided. The new Item 5 proposed by this comment will ensure that the habitable attic allowance is only permitted when sprinklers are provided, which is technically justified recognizing that: 1) Occupants located four stories above grade have a long way to go to escape against smoke and heat rising from a fire below that can block the interior stairs, and 2) Occupants four stories above grade cannot reasonably jump from escape windows or be readily rescued by fire department using ground ladders.

This comment reflects the approach taken a few years ago, when fire separations between unsprinklered townhouses were increased to 2-hours. The 2009 IRC had permitted all townhouse separations to be 1-hour because sprinklers were always required. But after it became clear that jurisdictions were not universally adopting the sprinkler requirement, the IRC was changed to reinstate a 2-hour rating for non-sprinklered buildings. In this case, the legacy approach of treating habitable attics as stories is being reinstated for non-sprinklered buildings.

In summary, it is the intent of this comment to ensure that application of the IRC remains consistent with the original allowance for habitable attics, which correlated with the requirement for sprinklers to be provided. The comment offers a reasonable and appropriate basis for continuing an allowance for habitable attics above the third story and is less punitive than the original proposal's suggestion to completely eliminate the option.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Technically, the IRC requires all buildings to be sprinklered, so this doesn't have a cost impact with respect to the model code. In jurisdictions that amend the IRC by removing the sprinkler requirement, there would be a cost increase if the habitable attic provisions were used.

Public Comment# 2152

Public Comment 6:

Proponents:

Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (jeffrey.hinderliter@dos.ny.gov); Gerard Hathaway, representing New York State Department of State (gerard.hathaway@dos.ny.gov)

requests As Submitted

Commenter's Reason: With this public comment we are re-introducing the original proposal As-Submitted to the "Committee Action Hearings" with no changes. This additional reason statement builds on and makes reference to the original reason statement. It is obvious from the testimony and committee discussions, that there is much misunderstanding regarding what this proposed change accomplishes. We realize this reason statement is long, but please push through it for an informed vote.

The Committee Reason for disapproval was as follows:

This is too restrictive. It should be acceptable on a 2-story house. All habitable attics should not be eliminated.

Proponent's Response to floor testimony, Committee discussion and Reason for Disapproval.

In rebuttal to the Committee Reason:

The RB152-19 (IRC R325.6) proposal does not eliminate the possibility of constructing habitable attics in one- or two-family dwellings and townhouses under the IRC up to and including above the 2nd floor. This proposal does not eliminate the possibility of constructing habitable space in attics above the 3rd floor, they would be regulated under the IBC as a 4-story dwelling with no limitations on floor area in relation to the floor below.

Where essentially you would be required to provide a better NFPA 13R sprinkler system. The cost of which is not overly burdensome when compared to the increased floor area allowed and much improved life safety features (see cost comparison at the end).

In rebuttal to floor testimony and committee discussion:

The definition of Habitable Attic is still in Chapter 2, unchanged from the 2018 IRC. It is important because it differentiates that area within the roof structure of a building which contains "habitable space" from a typical "attic" as defined. The definition, stating that a habitable attic can be finished or unfinished, takes away the arguments made by those who would seek to disqualify the area in question because it is unfinished in some way. When the area is being used for habitable space, all other requirements necessary for a space to be considered habitable must be provided.

We have simply proposed amending R325.6 Habitable Attic to call it a "story above grade plane". We also have removed Items 1 through 4 because once we consider a habitable attic a story; Items 1 & 2 are not necessary since all habitable spaces must meet those provisions, and Items 3 & 4 are not necessary since we no longer need to limit the size and configuration of the habitable attic because "it is a story". Enforcement becomes easier because you no longer need to be concerned if the following items which are gray areas for enforcement would disqualify a space from being considered a habitable attic, such as: providing small or large dormers, salt box, gambrel or other style roofs that create more space at that level.

Approval of the proposal would result in; a habitable attic above a 1-story dwelling would be considered a 2-story, a habitable attic above a 2-story dwelling would be considered a 3-story. However, a habitable attic above a 3-story dwelling would be considered a 4-story, which would make it beyond the scope of the IRC and would have to be regulated under the IBC. In the IBC that same habitable space whether under rafters or within a room truss is currently considered a story above grade plane. There is no Habitable Attic definition in the IBC.

This is an example of why a habitable space should not be exempted from being considered a story just because it is located under sloped rafters. Picture the 3-story dwelling shown in Figure 1 of our original reason statement with a flat roof, rather than sloped rafters above the 3rd floor. Then picture a smaller 4th level with a flat roof. Under both the current IBC and IRC that flat roof 4th level would be considered a story above grade plane, even if it were 1/3 to 1/2 the size of the area of the floor below. There is no reason why a sloped roof dwelling with a 4th level habitable attic regulated under the IRC, located next to a flat roof dwelling with a 4th story that is the same size and at the same height but regulated under the IBC should be allowed to have less fire protection features than required under the IBC. With typical wood frame (5b) construction the current IRC would allow the use of a Section P2903 sprinkler system (equivalent to NFPA 13D) with a 10-minute sprinkler duration for this 3-story building because the 4th level habitable attic is not considered a story. However, with the same type of construction the IBC would require an NFPA 13R sprinkler system because the 4th level would be considered a 4th story. The 13R sprinkler system requires additional sprinkler heads and a 30-minute sprinkler duration. Thus, giving more time to escape the taller building.

We agree with the fire service committee member who said that higher emergency escape and rescue openings (EEROs) in a 4th level or story above grade plane, that are beyond the reach of a typical 35-foot ladder, would be much riskier for both the fire fighter and the occupant (see Figure 1 of our original reason statement). The IBC does not even require EEROs above the 3rd story because they are ineffective for escape and rescue, and that is why a 13R sprinkler system is required.

The construction industry representative testified that allowing a habitable attic that is not considered a story above grade plane is needed because infill sites are typically restricted in lot size and you need to go more vertical. However, these same sites are typically in urban or coastal settings where access to fight fires may be limited to as little as one side. In locations where buildings are built that close together typically ample municipal water supply is available for sprinkler systems. The proposed change does not stop developers from going above the 3rd floor to 4 or more if the building has a higher type of construction and/or a 13R or 13 sprinkler system as shown on IBC Table 504.4. Increased life safety risks require increased life safety measures.

Townhouses are built in the same tight configuration as infill lots. Picture a row of 3-story homes, like the one shown in Figure 3 of our original reason statement, as regulated under the current IRC. Fire-fighting access could be somewhat limited. Additionally, there are often garages (adding fuel load) under the home on the walkout side. The garage level is not a story above grade plane and if the habitable attic is not considered a story above grade plane, the 5th level above where fire-fighting operations must be set up is only protected with a 13D sprinkler system with just a 10-minute sprinkler duration for the egress path down. Possibly there would be no sprinkler protection in municipalities that have opted out of the IRC sprinkler requirements.

Most states and municipalities have opted-out of the IRC sprinkler requirements. So, the only hope of protecting occupants above the 3rd story is to call a habitable attic a story above grade plane, requiring regulation under the IBC, and providing a 13R sprinkler system to help mitigate a significant life safety hazard.

It has also been suggested by many that limiting the square foot area of a habitable attic could be an acceptable compromise. Several have said that the habitable attic could be 1/3 of the area of the floor below if not sprinklered, and 1/2 of the area of the floor below if a sprinkler system is provided, similar to how mezzanines are treated. This does not make sense based on the following: According to R325.5 Openness, Exception Item 2,

a mezzanine is not required to be open to the room in which it is located when the building is equipped throughout with an automatic sprinkler system. However, this is allowed only in buildings of not more than 2-stories above grade plane. Therefore, a mezzanine is allowed in the 3rd story of a home, but must be open to the room in which it is located, even if a sprinkler system is provided. That said, why would a 4th level habitable attic,

enclosed to the 3rd-floor below, be acceptable?

Consider a modest 20 X 36-foot 3-story infill building or townhouse under the current IRC. Say you provide a habitable attic at the 4th level that is 1/3 of the floor below (720 sf.), which equals 240 sf. That is enough space for two 100 plus square foot bedrooms which could sleep two children each, totaling 4 children with no sprinkler protection required in opted out municipalities. In municipalities that require sprinklers per the IRC, 1/2 of the floor below (720 sf.) would be allowed, which equals 360 sf. That is enough space for three 100 plus square foot bedrooms which could sleep two children each, totaling 6 children protected with a 13D sprinkler system with just a 10-minute sprinkler duration for the egress path down 4 levels.

We know that these rooms may be used for purposes other than children's bedrooms, but upper stories, even if used for recreation rooms are often used for sleepovers just like finished basements. The compromise does not seem very acceptable when the cost of providing an upgraded fire sprinkler system is not overly burdensome.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The cost of upgrading from an NFPA 13D to an NFPA 13R sprinkler system with and increased cost estimated at \$1.35 per square foot, or \$3,594 for an averaged size house of 2,662 square feet, which represents a 1.03% cost increase.

Another more expensive option is shown in IBC Table 504.4, is to stay with an NFPA 13D sprinkler system and upgrade to a higher type of construction. The increased cost to upgrade from Vb to IIIb construction, by utilizing a fire retardant treated wood (FRTW) and type X gypsum board exterior wall assembly, is estimated at \$3.64 per square foot, or \$11,779 for an averaged sized house of 2,662 square feet. This represents a 3.38% cost increase.

Public Comment# 2007

RB154-19

IRC®: SECTION R202, [RB] 202, 202 (New), SECTION R327, R327.1, R327.2, R327.3, R327.3.1 (New), 327.3.2 (New), R327.3.3 (New), R327.3.4, R327.3.5, R327.3.6, R327.3.7 (New), Table R327.3.7 (New), R327.3.7.1 (New), R327.3.7.2 (New), R327.3.8 (New), R327.4 (New), R327.5 (New), R327.5.1 (New)

Proposed Change as Submitted

Proponents: Robert Davidson, Davidson Code Concepts, LLC, representing Tesla, USA (rjd@davidsoncodeconcepts.com); Kevin Reinertson, representing Riverside County Fire Department (kevin.reinertson@fire.ca.gov); Jack Applegate, representing City of Clatskanie, Oregon (jacka@nwcodepros.com)

2018 International Residential Code

SECTION R202 DEFINITIONS

Delete without substitution:

~~[RB] BATTERY SYSTEM, STATIONARY STORAGE. A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls and associated electrical equipment designed to provide electrical power to a building. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.~~

Add new definition as follows:

[RB] ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

Revise as follows:

SECTION R327 ~~STATIONARY ENERGY STORAGE BATTERY SYSTEMS~~

~~R327.1 General. Stationary storage battery system shall comply with the provisions of this section.~~

ESS shall be installed and maintained in accordance with Sections R327.2 through R327.4. The temporary use of an owner or occupant's electric powered vehicle as an ESS shall be in accordance with Section R327.5.

~~R327.2 Equipment listings. Stationary storage battery systems ESS 1 kWh or greater in maximum stored energy shall be listed and labeled for residential use in accordance with UL 9540.~~

Exceptions:

- ~~1. Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.~~
- ~~2. Battery systems that are an integral part of an electric vehicle are allowed provided that the installation complies with Section 625.48 of NFPA 70. ESS listed and labeled in accordance with UL 9540 solely for utility or commercial use installed in accordance with Section 1206 of the International Fire Code.~~
- ~~3. Battery systems less than 1 kWh (3.6 megajoules).~~

~~R327.3 Installation. Stationary storage battery systems ESS shall be installed in accordance with the manufacturer's instructions and their listing, if applicable, and shall not be installed within the living space or habitable space of a dwelling unit.~~

Add new text as follows:

R327.3.1 Spacing. Individual units shall be separated from each other by at least three feet of spacing unless smaller separation distances are documented to be adequate as approved by the code official based on large scale fire testing complying with Section 1206.1.5 of the International Fire Code.

327.3.2 Location. ESS shall only be installed in the locations listed in items 1 through 4.

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space and sleeping units in accordance with Section R302.6.
3. Outdoors on exterior walls or on the ground located a minimum 3 ft. from doors and windows.
4. Enclosed utility closets or spaces, or enclosed storage closets within dwelling units.

R327.3.3 Energy ratings. Individual ESS units shall have a maximum stored energy of 20 kWh. The aggregate rating within or outside the structure

shall not exceed:

1. 40 kWh within utility closets and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Section 1206 of the International Fire Code

Revise as follows:

~~R327.4~~ R327.3.4 **Electrical installation. ~~Stationary storage battery systems~~ ESS shall be installed in accordance with NFPA 70. Inverters shall be *listed* and *labeled* in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.**

~~R327.5~~ R327.3.5 **Ventilation. Indoor installations of ~~stationary storage battery systems~~ ESS that include batteries that produce hydrogen or other flammable gases during ~~charging~~ normal operation shall be provided with ventilation in accordance with Section ~~M1307.4~~ M1307.4.2.**

~~R327.6~~ R327.3.6 **Protection from impact. ~~Stationary storage battery systems~~ ESS installed in a location subject to vehicle damage shall be protected by approved barriers.**

Add new text as follows:

R327.3.7 **Fire separation When located within a garage, utility closet or space, or storage closet, the garage, room or space shall be separated as required by Table R327.3.7. Attachment of gypsum board shall comply with Table R702.3.5. The wall separation provisions of Table R327.3.7 shall not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.**

**Table R327.3.7
ESS Fire Separation**

SEPARATION	MATERIAL
From the residence and attics	Not less than 1/2-inch gypsum board or equivalent applied to the garage, room or space side
From habitable rooms above the garage, room or space	Not less than 5/8-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than 1/2-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than 1/2-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

R327.3.7.1 Openings. Openings from a garage, room or space directly into a room used for sleeping purposes shall be prohibited.

R327.3.7.2 Penetrations. Penetration protection shall be provided at openings in walls, ceilings and floors around vents, pipes, ducts, cables and wires, with an approved material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the ASTM E136 requirements.

R327.3.8 Fire detection. Interconnected smoke alarms shall be installed throughout the dwelling in accordance with Section R314, including in the room or area within the dwelling or attached garage in which the ESS are installed. A heat detector listed and interconnected to the smoke alarms shall be installed in the room or area within the dwelling or attached garage in which the ESS is installed where smoke alarms cannot be installed based on their listing.

R327.4 Toxic and highly toxic gas. ESS that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall be installed outdoors.

R327.5 Electric vehicle use. The temporary use of an owner or occupant's electric powered vehicle to power a dwelling unit while parked in an attached or detached garage or outside shall comply with the vehicle manufacturer's instructions and NFPA 70. The batteries on electric vehicles shall not contribute to the aggregate energy limitations in Section R327.4.3.

R327.5.1 Temporary. The temporary use of the dwelling unit owner's or occupant's electric-powered vehicle to power the dwelling while parked in an attached or detached garage or outside shall not exceed 30 days.

Reason: Last cycle the portion of the International Fire Code dealing with Stationary Battery Storage Systems was heavily rewritten by the Energy Storage Work Group of the ICC Fire Code Action Committee to address changes in technology and application of battery storage systems. When that work was accepted by the IFC Committee and the voting membership, new Section R327 was added to the International Residential Code to provide for some core requirements when the systems are installed in one- and two-family dwellings and townhouses. Simultaneous to that work, NFPA created a new NFPA 855 Energy Storage Systems Standard for a comprehensive document addressing the hazards of energy storage systems. The ICC FCAC Energy Storage Work Group continued to work on the topic in coordination with the work being done by the NFPA 855 committee to keep the technical details of the documents as coordinated as possible. As a result, the new requirements in the 2018 edition of the IFC have been heavily updated as to structure and the topics covered.

This proposal is an outgrowth of work done by the NFPA 855 Committee specific to one- and two-family dwellings and townhouses as well as new language added to the IFC for the 2021 edition addressing R-3 and R-4 Group Occupancies.

The concerns identified for one and two-family dwellings and townhouses dealt with:

- Where the ESS units could be located.
- Energy rating maximum of individual units.
- Aggregate energy ratings when more than one unit is installed.
- Linkage to the fire code when energy limitations are exceeded.
- Fire separation.
- Fire detection.
- ESS that may produce toxic or highly toxic gases during operation.
- Temporary use of electric vehicle as ESS for the dwelling.

The breakdown of the suggested changes are as follows:

New definition: The definition for Energy Storage Systems (ESS) from the IFC has been brought over to the IRC for consistency of terminology between the IFC and NFPA 855.

R327 generally: The term Energy Storage Systems has replaced the term Stationary Storage Battery Systems.

R327.1: Has been modified to identify the sections ESS shall comply with and to add a separate pointer for the section applicable to the temporary use of an electric vehicle as an ESS.

R327.2: Has been modified to pull the exception for the systems with less than 1 kWh and provide it as the energy rating level trigger for cleaner application of the requirements. Exception 2 has been deleted since the use of electric vehicles is covered by the new section R327.5. In its place language has been added providing for the installation of utility or commercial listed systems (not listed for residential use) to be outside the dwelling and to be in accordance with the IFC. Exception 3 is deleted since that topic is now covered by the initial language at the start of R327.2.

R327.3: Has been modified to replace the current terminology with ESS, and a restriction against installation in “living space” has been added to address concerns that there are other locations such as hallways that are not covered by the existing restriction for habitable spaces. That addition provides consistency with language added to NFPA 855.

New R327.3.1: Adds a separation requirement of 3 feet between ESS units unless large scale testing has documented that an event in one unit will not propagate to the next unit.

New R327.3.2: Adds a listing of specific installation locations consistent with the IFC R-3 and R-4 locations and NFPA 855.

New R327.3.3: Provides a limitation on the maximum energy rating of an individual unit as well as an aggregate energy rating for specific installation locations. The size of an event is directly correlated to the amount of energy stored. It then provides that if increased energy above these limits is desired the installation shall be done in accordance with the IFC.

R327.3.4 (Prior R327.4): Has been modified to replace the current terminology with ESS.

R327.3.5 (Prior R327.5): Has been modified to replace the current terminology with ESS. The term “charging” has been replaced with the phrase “normal operation”. It doesn’t matter at what point the gases are produced, they need to be exhausted. Section M1307.4 was changed to Section 1307.4.2 to clarify this is a mechanical exhaust system that is required.

R327.3.6 (Prior R327.6): Has been modified to replace the current terminology with ESS.

New R327.3.7: This section has been added to address the need for fire separation. When an event occurs, it cannot always be extinguished with water. Exposures would be wetted while the unit burns itself out. For that reason, separation is needed to assist in preventing fire spread. The language from existing Section 302.6 was taken for consistency and editorially modified slightly to fit this area of the code.

New R327.3.7.1: Adds the first sentence of existing Section R302.5.1 to keep rooms or spaces with ESS from opening into areas for sleeping purposes. (The remainder of R302.5.1 concerning doors and closures is part of a separate proposal).

New R327.3.7.2: Adds language from existing Section R302.11, Item 4, (as referenced by existing R302.5.3), with editorial changes to fit this application.

New R327.3.8: Adds a requirement that when ESS is installed the dwelling must have an interconnected smoke alarm system with a smoke alarm installed in the room or space the ESS is located for early warning of an event. If the space is not conducive to the installation of a smoke alarm a listed heat alarm can be installed and interconnected to the smoke alarm system.

New R327.4: Provides that an ESS that has the potential to release toxic or highly toxic gases during normal use shall be installed outdoors.

New R327.5: Provides for the temporary use of an electric vehicle as an ESS to power the dwelling provide it is done in compliance with the NEC and the manufacturer’s instructions. The requirement for the manufacturer’s instruction compliance ensures that only electric vehicles designed and manufactured for use as an ESS are utilized as compared to someone adding non-approved electrical connections to an existing electric vehicle not designed for this purpose. Temporary is further defined as 30 days with new Section R327.5.1.

These changes will provide for correlation with the new language added to the IFC as well as enhancements made when the language was added to NFPA 855. This correlation provides for consistency or requirements across codes and standards.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposed change does not impact the cost of construction of one- or two-family dwellings and townhouses. ESS are specialty systems typically installed in an existing dwelling by the current owner. In the rare case that a new custom home owner desires installation of ESS as part of the construction of the custom home, these requirements impact the cost of the ESS portion of the installation not the home itself. The separation requirements were intentionally matched to the existing private garage separation requirements for correlation with construction of the home. These requirements will increase the cost of installation of ESS.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are concerns with much of the language. Regarding R327.3, installation, there is a reference to "living space," which does not include closets or corridors. Yet for acceptable locations they talk about storage closets. That is a conflict. For locations on the exterior, there are potential sensitivity issues with batteries, especially in hot and cold climates. In ventilation Section R327.3.5, they changed the section of the mechanical code which they referenced, which eliminates active natural ventilation. Regarding the references to temporary vehicles, it would be difficult for code officials to verify temporary vehicle use. Section R327.5 has problems in that the last referenced section does not exist. R327 talks about maintenance in the scoping, but there are no maintenance provisions. R327.4 talks about the potential to release toxic or highly toxic gasses. What is the difference? How does the code official verify that? Is that part of the UL listing? There are a lot of pieces that need work. (Vote: 10-1)

Assembly Action:

None

RB154-19

Individual Consideration Agenda

Public Comment 1:

IRC@: SECTION R327, R327.1, R327.2, R327.3, R327.3.1 (New), R327.4 (New), R327.5 (New), R327.6, R327.7 (New), R327.8, R327.9, R327.10 (New)

Proponents:

Howard Hopper, representing UL LLC (howard.d.hopper@ul.com); Jeff Spies - Representing SEAC, Representing SEAC for this proposal. My employer is Planet Plan Sets, representing Sustainable Energy Action Committee (SEAC) (jeff.spies@planetplansets.com); Benjamin Davis, California Solar & Storage Association, representing California Solar & Storage Association (ben@calssa.org); Michael Schmeida, representing Gypsum Association (mschmeida@gypsum.org); Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Matt Paiss, Pacific Northwest National Laboratory, representing International Association of Fire Fighters (matthew.paiss@pnnl.gov); Tim Earl, representing GBH International (tearl@gbhinternational.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

SECTION R327 **ENERGY STORAGE STATIONARY STORAGE BATTERY SYSTEMS**

R327.1 General. ~~Stationary storage battery systems~~ Energy storage systems (ESS) shall comply with the provisions of this section.

Exceptions:

1. ESS listed and labeled in accordance with UL 9540 and marked "For use in residential dwelling units", where installed in accordance with the manufacturer's instructions and NFPA 70.
2. ESS less than 1 kWh (3.6 megajoules).

R327.2 Equipment listings. ~~Stationary storage battery systems~~ ESS shall be listed and labeled for residential use in accordance with UL 9540.

Exceptions-Exception:

1. ~~Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.~~
2. ~~Battery systems that are an integral part of an electric vehicle are allowed provided that the installation complies with Section 625.48 of NFPA 70.~~

3- ~~Battery systems less than 1 kWh (3.6 megajoules)-~~

R327.3 Installation. ~~Stationary storage battery systems~~ ESS shall be installed in accordance with the manufacturer's instructions and their *listing*, if applicable, and shall not be installed within the habitable space of a dwelling unit.

R327.3.1 Spacing Individual units shall be separated from each other by not less than three feet (914 mm) except where smaller separation distances are documented to be adequate based on large scale fire testing complying with Section 1206.1.5 of the *International Fire Code*.

R327.4 Locations. ESS shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space in accordance with Section R302.6
3. Outdoors or on the exterior side of exterior walls located not less than 3 feet (914 mm) from doors and windows directly entering the dwelling unit.
4. Enclosed utility closets, basements, storage or utility spaces within dwelling units with finished or noncombustible walls and ceilings. Walls and ceilings of unfinished wood-framed construction shall be provided with not less than 5/8 inch Type X gypsum wallboard.

ESS shall not be installed in sleeping rooms, or closets or spaces opening directly into sleeping rooms.

R327.5 Energy ratings. Individual ESS units shall have a maximum rating of 20 kWh. The aggregate rating of the ESS shall not exceed:

1. 40 kWh within utility closets, basements, and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Sections 1206.1 through 1206.9 of the International Fire Code.

R327.6 R327-4 Electrical installation. ~~Stationary storage battery systems~~ ESS shall be installed in accordance with NFPA 70. Inverters shall be *listed* and *labeled* in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

R327.7 Fire detection. Rooms and areas within dwellings units, basements, and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section R314. A heat detector, listed and interconnected to the smoke alarms, shall be installed in locations within dwelling units and attached garages where smoke alarms cannot be installed based on their listing.

R327.8 R327-6 Protection from impact. ~~Stationary storage battery systems~~ ESS installed in a location subject to vehicle damage shall be protected by approved barriers.

R327.9 R327-5 Ventilation. Indoor installations of ~~stationary storage battery systems~~ ESS that include batteries that produce hydrogen or other flammable gases during charging shall be provided with mechanical ventilation in accordance with Section M1307.4.

R327.10 Electric vehicle use. The temporary use of an owner or occupant's electric powered vehicle to power a dwelling unit while parked in an attached or detached garage or outdoors shall comply with the vehicle manufacturer's instructions and NFPA 70.

Commenter's Reason: At the committee action hearing several proponents provided testimony for different proposals to update the stationary storage battery provisions. The committee rightfully voted to disapproved all of the proposals until concerns with each were addressed. The one ESS proposal approved by the committee, F158-19, was solely an editorial change that changed reference from "stationary battery systems" to "energy storage systems" (ESS), to match IFC terminology.

Group A change F203-18 created a new section 1206.11 which covered ESS in Group R-3 and R-4 occupancies. Those requirements were also consistent with requirements in the new NFPA 855 energy storage system standard. Proposal RB154-19 included many of those requirements.

This public comment replaces the RB 154-18 proposal, and reflects what is believed to be a consensus of all proponents of the different ESS proposals. Comments on individual section are as follows:

R327.1 – This section includes the current 1 kWh threshold, and exempts a UL 9540 listed ESS that will not go into thermal runaway or produce flammable gas when subject to the UL 9540A Cell Level test. See proposal RB157-18.

R327.2 The equipment listing requirements are based on R327.2 in the 2018 IRC. The reference to "residential use" was removed since this is not a specific requirements in UL 9540, the standard used to list the equipment.

R327.3 Installation requirements are unchanged from the 2018 IRC (R327.3)

R327.3.1 Spacing between ESS are identical to spacing requirements in the 2021 IFC and NFPA 855, including an exception for decreasing spacings based on UL 9540A large scale fire testing.

R327.4 The locations where ESS are allowed is similar to the 2021 IFC and NFPA 855, with the following modifications:

- Item 3 corrected an oversight and allows ground mounted ESS to be installed adjacent to buildings on the property.
- Item 4 addressed concerns raised in proposals RB154, RB155, RB156, RB157 about ESS installations in utility closets, basements, storage or utility spaces.
- The last sentence clarifies that ESS is not allowed in sleeping rooms or closets or spaces opening directly into them.

R327.5 Energy ratings are identical to the values included in the in the 2021 IFC and NFPA 855. Allowing ESS with energy ratings above the values described to comply with ESS requirements for commercial systems (i.e. the IFC requirements) is allowed in NFPA 855.

R327.6 Electrical installation requirements are unchanged from the 2018 IRC. (R327.4)

R327.7 Fire detection includes the same requirements as the 2021 IFC and NFPA 855, with minor edits.

R327.8 Vehicle impact protection requirements are unchanged from the 2018 IRC. (R327.6)

R327.9 Ventilation requirements are based on R327.5 of the 2018 IRC. ESS utilizing battery technologies such as lithium-ion batteries do not require mechanical ventilation since they do not produce flammable gases during charging.

R327.10 Electric vehicle use is based on R327.2 (2) of the 2018 IRC, and the 2021 IFC and NFPA 855.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The new requirements have the potential to increase the cost of an ESS installation, but only if the homeowner chooses to have ESS installed.

Public Comment# 1519

RB156-19

IRC@: R327.3

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R327.3 Installation. *Stationary storage battery systems shall be listed and installed in accordance with the manufacturer's instructions and their listing, if applicable, and shall not be installed within the habitable space only in the following locations of a dwelling unit.*

1. In attached garages separated from the dwelling unit living and sleeping spaces in accordance with Section R302.6.
2. In detached garages.
3. In detached accessory structures.
4. Outdoors on exterior walls and located at a distance of not less than 3 ft. from doors and windows.

Reason: This revision corrects a problem with the existing code that allows the installation of ESS units in closets and other storage spaces without any special precautions, which is unsafe. The definition of habitable space in the IRC (A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.) specifically points out that closets and storage spaces are not habitable spaces. This revision also requires ESS units to be listed.

Cost Impact: The code change proposal will increase the cost of construction
This proposal may require special provisions for installation of ESS units.

RB156-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal is not evidence based. This proponents bans all storage battery technology because the proponent is uncomfortable with lithium ion. The hope is that the proponents work with the industry to create a public comment to create some room in the house where this type of equipment can be installed safely. (Vote: 9-2)

Assembly Action:

None

RB156-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Submitted

Commenter's Reason: As stated in the original proposal, this revision corrects a problem with the existing code in that the IRC allows the installation of ESS units in closets and other storage spaces without any special precautions, which is unsafe. The definition of habitable space in the IRC (A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.) specifically points out that closets and storage spaces are not habitable spaces. The potential fire hazard associated with ESS systems is not restricted to Lithium ion batteries.

This revision requires ESS units to be listed, which is consistent with other proposals and expected public comments.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This code proposal has the potential to require additional protection when installing ESS systems.

RB161-19

IRC®: R328 (New), R328.1 (New), R328.1.1 (New), R328.2 (New), R328.2.1 (New), R328.2.2 (New), R328.2.3 (New), R328.2.4 (New), R328.2.5 (New), R328.3 (New), R328.3.1 (New), R328.3.2 (New), R328.4 (New), R328.5 (New), R328.5.1 (New), R328.5.2 (New), R328.5.3 (New), R328.5.4 (New), R328.5.5 (New), R328.6 (New), ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Eirene Knott, BRR Architecture, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com); David Allen, representing Edward Wayne Inc. (davidallen89@att.net); Ron Olberding, representing Edward Wayne Inc. (ronolberding@sbcglobal.net)

2018 International Residential Code

Add new text as follows:

R328 **Physical Security**

R328.1 Purpose. The purpose of this section is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

R328.1.1 Scope. The provisions of this section shall apply to all new structures and to additions and alterations made to existing buildings.

R328.2 Doors. All exterior swinging doors of residential dwelling units and attached garages, including doors leading from the garage area into the dwelling unit, shall comply with Sections R328.2.1 through R328.2.5 based on the type of door installed.

Exception: Vehicular access doors

R328.2.1 Wood doors. Exterior wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.

R328.2.2 Steel doors. Exterior steel doors shall be a minimum thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

R328.2.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

R328.2.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the doorframe, or by other approved methods.

R328.2.5 Sliding doors. Exterior sliding doors shall be installed to prevent the removal of the panels from the exterior.

R328.3 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Horizontal blocking shall be placed between studs at the door lock height for three stud spaces or equivalent bracing on each side of the door opening. Door frames shall comply with Sections R328.3.1 through R328.3.2 based on the type of door installed.

R328.3.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelights, shall be reinforced in accordance with ASTM F476 Grade 40 bolt and hinge impact only.

R328.3.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel and reinforced at the hinges and strikes. Doors are to be anchored to the wall in accordance with the manufacturer's instructions.

R328.4 Door jambs. Door jambs on wooden jambs for in-swinging doors shall be of one-piece construction.

R328.5 Door hardware. Exterior door hardware shall comply with Sections R328.5.1 through R328.5.5.

R328.5.1 Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure shall be used. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

R328.5.2 Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's edge.

R328.5.3 Locks. Exterior doors shall be provided with a deadbolt with a minimum grade 2 as determined by ANSI/BHMA.

R328.5.4 Entry vision and glazing. All main or front entry doors to dwelling units shall be arranged so that the occupant has a view of the area immediately outside the door without opening the door. The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.

R328.5.5 Side light entry doors. Side light doors units shall have framing of double stud construction or equivalent construction complying with Sections R328.3.1 or R328.3.2. The door frame that separates the door opening from the side light, whether on the latch side or the hinge side, shall be double stud construction or equivalent construction complying with Sections R328.3.1 or R328.3.2. Double stud construction or equivalent construction shall exist between the glazing unit of the side light and the wall structure of the dwelling.

R328.6 Alternate materials and methods of construction. The provisions of this section are not intended to prevent the use of any material or method of construction not specifically prescribed by this section, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this section. The materials, method of construction and structural design limitations provided for in this section shall be used, unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this section.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F476 - 14: Standard Test Methods for Security of Swinging Door Assemblies

Reason: In the summer of 1996, Overland Park, Kansas, experienced a series of home invasions resulting in the sexual assault of several women. For the victims of a home invasion, it's more than a property crime; it scares the victim into thinking that the criminal will return only to commit a more violent or heinous crime. To have an emotional investment in their residence is priceless.

As a result of these home invasions, the City's Police Department conducted hundreds of surveys of residents in an effort to develop a solution to the home invasions. The results of the surveys lead the City to develop a building code that makes home more safe and secure. You may ask, why secure the front door? What about installing an alarm? Communities across the country continue to report a growing increase in false alarms. In an effort to provide physical security to the homeowner, there needs to be a more reliable option available.

The longer a criminal spends trying to gain access to a home, the greater the risk of detection. In addition, most home invaders will not attempt to break a window, as that makes noise that neighbors could potentially hear. Rather than face these risks, the invader is more likely to try to kick in an exterior door, where they can easily gain access without being detected.

This code change will provide for minimal provisions to be made to a new home under construction that will give the homeowner safety and peace of mind, while delaying and frustrating the criminal. Since this proposal is not dependent on electrical power, these provisions will always be available to the homeowner and will require no further action after installation. There is no on-going cost to the homeowner and these provisions will not affect the overall aesthetics of the home.

Cost Impact: The code change proposal will increase the cost of construction
The cost to secure a single door ranges from \$40-\$60 for a single door unit and between \$140 and \$180 for a double sidelite unit.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM F476 and ANSI/BHMA, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB161-19

Public Hearing Results

Errata: This proposal includes published errata
Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The committee applauds the proponents time and effort. But this goes well beyond the minimum. It should be an appendix chapter. This is outside the scope of the IRC. The building codes are not crime prevention codes. There are opening requirements and people sometimes like to have their windows open a night. If they are not home, people go through the window if they can't go through the front door. There may be a false sense of security. R328.1 is commentary. There should not be a separate scope for an individual section. The language regarding fiberglass doors is vague. These are best practices and do not belong in the codes. This is probably more suited to urban environments and may not be appropriate for all areas of the country. (Vote: 10-1)

Assembly Action:

None

RB161-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R328 (New), R328.1 (New), R328.1.1 (New), R328.2 (New), R328.2.1 (New), R328.2.2 (New), R328.2.3 (New), R328.2.4 (New), R328.2.5 (New), R328.3 (New), R328.3.1 (New), R328.3.2 (New), R328.3.3 (New), R328.4 (New), R328.4.1 (New), R328.4.2 (New), R328.5.3 (New), R328.4.4 (New), R328.6 (New), ANSI Chapter 44 (New), ASTM Chapter 44 (New)

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com); David Allen, Edward Wayne Inc., representing Edward Wayne (davidallen89@att.net); Ron Olberding, representing Edward Wayne (ronolberding@sbcglobal.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R328 Physical Security

R328.1 Purpose. The purpose of this section is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

R328.1.1 Scope Application. The provisions of this section shall apply to all new structures and to additions and alterations made to existing buildings as provided for in Section R102.7.1.

R328.2 Doors. All exterior ~~swinging doors of residential dwelling units and attached garages, including and~~ doors leading from the garage area into the dwelling unit, shall comply with Sections R328.2.1 through R328.2.5 based on the type of door installed.

Exception-Exceptions:

1. Vehicle access doors
2. Storm or screen doors

R328.2.1 Wood doors. ~~Exterior w~~ Wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) where measured at the locking device or hinge, at any point. ~~Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.~~

R328.2.2 Steel doors. ~~Exterior s~~ Steel doors shall be a minimum skin thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

R328.2.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

R328.2.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the doorframe, or by other approved methods.

R328.2.5 Sliding doors. ~~Exterior s~~ Sliding doors shall be installed to prevent the removal of the panels from the exterior.

R328.3 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Two-inch nominal wood ~~Horizontal~~ blocking shall be placed horizontally between studs at the door lock height for three one stud spaces ~~or equivalent bracing~~ on each side of the door opening. Door frames shall comply with ASTM F476 Grade 40 for the bolt and hinge impact tests. Door frames shall comply with Sections R328.3.1 through ~~R328.3.2~~ R328.3.3 based on the type of door installed.

R328.3.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelite lights, shall be reinforced ~~in accordance with ASTM F476 Grade 40 bolt and hinge impact only.~~

R328.3.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel ~~and reinforced at the hinges and strikes.~~ Doors ~~are to~~ shall be anchored to the wall in accordance with the manufacturer's instructions.

~~R328.5.5~~ R328.3.3 Sidelite light entries entry doors. Sidelite light doors units shall have framing of double stud construction or equivalent construction ~~complying with Sections R328.3.1 or R328.3.2.~~ ~~The door frame that separates the door opening from the side light, whether on the latch side or the hinge side, shall be double stud construction or equivalent construction complying with Sections R328.3.1 or R328.3.2.~~ Double stud

construction or equivalent construction shall exist between the glazing unit of the sidelite side light and the wall structure of the dwelling.

~~R328.4 Door jambs.~~ Door jambs on wooden jambs for in-swinging doors shall be of one-piece construction.

~~R328.4 R328.5 Door hardware.~~ Exterior door hardware shall comply with Sections R328.4.1 ~~R328.5.1~~ through R328.4.4 ~~R318.5.5~~.

~~R328.5.1~~ R328.4.1 Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure ~~shall be used~~. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

Exception: Sidelite doors complying with ASTM F476 for the bolt and hinge impact tests.

~~R328.5.2~~ R328.4.2 Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's edge at the location of the deadbolt.

R328.5.3 Locks. Exterior doors shall be provided with a deadbolt with a minimum grade 2-B as determined by ANSI/BHMA A156.40.

~~R328.5.4 R328.4.4 Entry vision and glazing.~~ All main or front entry doors to dwelling units shall be arranged so that the occupant has a 180 degree view of the area immediately outside the door without opening the door. ~~The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.~~

~~R328.6 Alternate materials and methods of construction.~~ The provisions of this section are not intended to prevent the use of any material or method of construction not specifically prescribed by this section, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this section. The materials, method of construction and structural design limitations provided for in this section shall be used, unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this section.

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York NY 10036

A156.40: American National Standard for Residential Deadbolts

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F476 - 14: Standard Test Methods for Security of Swinging Door Assemblies

Commenter's Reason: One of the concerns the committee expressed was that this code change goes beyond the minimum requirements of the IRC. Per Section R101.3, the purpose of the IRC is to safeguard the public safety in general as well as for safety to life and property from fire and other hazards attributed to the built environment. How is protecting the occupants of a home from unwanted physical entry not providing a minimum level of protection for the public safety?

Another concern expressed by the committee was that the building code is not a crime prevention code. We agree with the committee. However, the code does address life safety, which is what we believe this code change covers.

One of the committee members expressed concerns about window opening requirements and that someone wanting entry would enter through the window. This code change is not about windows so we're not sure what the committee's concern was regarding windows. The FBI Uniform Crime Report shows that the majority of break-ins occur through an exterior door, which is what this code change is addressing.

Another committee comment was that this language is commentary. This code change includes code language, so we're not sure what the committee meant by that as commentary is generally language defining the code requirements.

In regards to the statement made by the committee about a false sense of security, current construction practices technically give a false sense of security as there are no requirements for any sense of security to a home owner in the current IRC. If someone wants to break into a home, they will find a way to do so. Much like a smoke detector provides the homeowner ample time to respond to a possible fire, this code change is an attempt to provide the homeowner ample time to respond to an attempted break-in.

What helps to prevent crime is witness potential. By delaying the potential entry into a home, the probability of a witness increases. Whether you live in a rural or urban environment, this code change provides the homeowner ample time to respond.

We believe that we have addressed concerns expressed by not only the committee but others who spoke in opposition with the language presented

in this public comment.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost to secure a single door ranges from \$40-60 for a single door unit and between \$140-180 for a double side light unit.

Public Comment# 1385

RB162-19

IRC®: 202 (New), R328.1 (New), R328.2, R328.3, ASTM Chapter 44 (New), SECTION, AO101.1, SECTION AO102, 202, SECTION AO103, AO103.1, AO103.2, SECTION AO104

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL LLC, representing UL LLC (jonathan.roberts@ul.com)

2018 International Residential Code

Add new definition as follows:

VEHICULAR GATE. A moveable barrier that is intended for use at a vehicle entrance or exit and not intended for use by pedestrian traffic.

Add new text as follows:

R328.1 General. Where provided, automatic vehicular gates shall comply with the requirements of Sections R328.2 and R328.3.

R328.2 Vehicular gates intended for automation. Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

R328.3 Vehicular gate openers. Vehicular gate openers shall be listed in accordance with UL 325.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F2200-14: Standard Specification for Automated Vehicular Gate Construction

Delete without substitution:

~~SECTION AO101 GENERAL~~

~~AO101.1 General.~~ The provisions of this appendix shall control the design and construction of automatic vehicular gates installed on the lot of a one- or two-family dwelling.

~~SECTION AO102 DEFINITION~~

~~VEHICULAR GATE.~~ A gate that is intended for use at a vehicular entrance or exit to the lot of a one- or two-family dwelling, and that is not intended for use by pedestrian traffic.

~~SECTION AO103 AUTOMATIC VEHICULAR GATES~~

~~AO103.1 Vehicular gates intended for automation.~~ Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

~~AO103.2 Vehicular gate openers.~~ Vehicular gate openers, where provided, shall be listed in accordance with UL 325.

~~SECTION AO104 REFERENCED STANDARDS~~

ASTM F2200—14	Standard Specification for Automated Vehicular Gate Construction	AO103.1
UL 325—02	Door, Drapery, Gate, Louver and Window Operations and Systems—with revisions through May 2015	AO103.2

Reason: This proposal recognizes the importance of safety by moving the requirements for automatic vehicular gates from Appendix O to the body of the code. It does not require the use of automated vehicular gates, but where vehicular gates are provided, it requires them to meet the same safety standards that are in the IBC (Section 3110) and the IFC (Sections 503.5 and 503.6.).

In 2018, CPSC launched “Operation Safe Gate” to put an end to preventable tragedies caused by automatic security gates. CPSC estimates that there are about 300 emergency room injuries each year due to automatic gates. Many of the injuries have been serious and resulted in cuts, broken bones, hematomas and amputations. In addition, CPSC has received four tragic reports of fatalities in recent years, including an 8 year old, an 11 year old and a 12 year old.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal does not require vehicular gates to be installed. There are numerous automated vehicular gates that already comply with these safety standards, so when these are used there will be no increase in costs.

Staff Analysis: The referenced standard, ASTM F2200, is currently referenced in other 2018 I-codes.

RB162-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal creates two sections that deal with additions and alterations. Existing Section R102.7.1 must be addressed to make this proposal work. This should be addressed by public comment. The modifications were improvements, but they were not enough. This does not belong in the body of the IRC. (Vote: 7-3)

Assembly Action:

None

RB162-19

Individual Consideration Agenda

Public Comment 1:

IRC®: 202 (New), R309.4, R328 (New), R328.1 (New), R328.2, R328.3, APPENDIX O, ASTM Chapter 44 (New), UL Chapter 44

Proponents:

Jonathan Roberts, representing UL LLC (jonathan.roberts@ul.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

VEHICULAR GATE.

A moveable barrier, other than a garage door, that is intended for use at a vehicle entrance or exit and ~~not intended for use~~ primarily used by pedestrian vehicular traffic.

R309.4 Automatic garage door openers and automatic vehicular gates. Automatic garage door openers, if provided, shall be *listed* and *labeled* in accordance with UL 325. Automatic vehicular gates, if provided, shall comply with Section 328.

R328

Automatic Vehicular Gates

R328.1 General. Where provided, automatic *vehicular gates* shall comply with the requirements of Sections R328.2 and R328.3.

R328.2 Vehicular gates intended for automation. *Vehicular gates* intended for automation shall be designed, constructed, and installed to comply with the requirements of ASTM F2200.

R328.3 Vehicular gate openers. *Vehicular gate* openers shall be *listed* in accordance with UL 325.

APPENDIX O

AUTOMATIC VEHICULAR GATES (Entire appendix to be deleted)

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428



325—02: Door, Drapery, Gate, Louver and Window Operators and Systems—with revisions through May 2015

Commenter's Reason: As part of this public comment the following editorial changes have been made:

- Language has been added to the definition to differentiate a garage door from a vehicular gate.
- Automatic vehicular gates have been added to R309.4, as a pointer to new Section 328.
- The Section 328 heading has been added.
- The Section 328 reference has been added to ASTM F2200 under Reference Standards.
- The Section 309 and Section 328 references have been added to UL 325 under Reference Standards.
- The UL 325 title has been revised.

We have also attempted to address the comments brought forth by the Committee and the NAHB as follows:

1. Removal of one- and two-family dwellings from the definition makes the application too broad.
 - It is our understanding that the scope of the IRC is applicable and pertains to these types devices. Examples of this would include lots containing lodging houses and townhouses, which can use automated vehicular gates, as well as the lots of one- and two-family dwellings.
2. Although vehicular access gates are used primarily for vehicles, they can act as pedestrian access in residential applications.
 - Although UL 325 and the gate operator installation instructions call for a separate pedestrian entrance to be installed, pedestrians may pass through the gate opening on residential properties. Thus, it becomes especially important to have a UL 325 and ASTM F2200 compliant gate to protect individual from becoming trapped between a moving gate and any fixed object.
3. The CPSC injury data shows no residential-based events.
 - The CPSC will not use this as a basis for residential installations to not comply with UL 325 and ASTM F2200. The same risks affect those installations as they do non-residential installations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal does not require vehicular gates to be installed. There are numerous automated vehicular gates that already comply with these safety standards, so when these are used there will be no increase in costs.

RB163-19

IRC@: SECTION R328 (New), R328.1 (New), R328.2 (New), R328.3 (New)

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

2018 International Residential Code

Add new text as follows:

SECTION R328 **ALTERATIONS AND ADDITIONS**

R328.1 General. Additions and Alterations to detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above grade plane in height, shall comply with this code or the *International Existing Building Code*. Where the alteration includes a change of use or occupancy to one not within the scope of the *International Residential Code*, the alteration shall comply with the *International Existing Building Code*.

R328.2 Additions. Additions to buildings within the scope of the *International Residential Code* shall comply with the requirements of the *International Residential Code* for new construction. *Alterations* to the existing building or structure shall be such that the existing building or structure together with the addition is not less compliant with the provisions of the *International Residential Code* than the existing building or structure was prior to the addition. An existing building together with its additions shall comply with the height limits of the *International Residential Code*.

R328.3 Alterations. Alterations to any building or structure within the scope of the *International Residential Code* shall comply with the requirements of the *International Residential Code* for new construction. *Alterations* shall be such that the existing building or structure is not less compliant with the provisions of the *International Residential Code* than the existing building or structure was prior to the *alteration*.

Reason: This proposed code change is editorial in nature and cross reference the IEBC in similar fashion to the way the IEBC provides the IRC as an option for compliance in the exception to Section 101.2. The code change also fills a gap regarding additions and alterations since the two scopes of work that are defined in Chapter 2 are only used within specific sections such as smoke alarm and carbon monoxide alarm requirements for example. The proposed general text is extracted from the IEBC prescriptive method sections in chapter 5. The alterations section also clarifies that you only need to go to the IEBC if the alteration changes the occupancy or use to one not regulated by the IRC. Chapter 3 was selected in lieu of chapter 1 since some jurisdictions may not adopt Chapter 1 of the IRC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposed code change is editorial in nature and does not add new standards.

RB163-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal adds language that duplicates existing text. Please come back with a public comment that addresses this.
(Vote: 10-1)

Assembly Action:

None

RB163-19

Individual Consideration Agenda

Public Comment 1:

IRC@: SECTION R328 (New), R328.1 (New), R328.2 (New), R328.3 (New), R328.4 (New), R328.5 (New)

Proponents:

David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

SECTION R328 **EXISTING STRUCTURAL ELEMENTS**

R328.1 General. Additions, alterations or repairs to any building shall conform to the requirements for a new building without requiring the existing structural elements to comply with the requirements of this code, unless otherwise stated. Additions, alterations, repairs and relocations shall not cause an existing structure to become dangerous. Buildings located in flood hazard areas shall comply with Section R105.3.1.1.

R328.2 Additions. Where an addition would not be structurally independent, the existing structure and the addition considered together shall be no less compliant with the structural provisions of this code than the existing structure prior to the addition. An existing structure together with its additions shall comply with the height limits of this code.

R328.3 Alterations. An altered structure shall be no less compliant with the structural provisions of this code than the existing structure prior to the alteration.

R328.4 Repairs. A repaired structure shall be no less compliant with the structural provisions of this code than the existing structure prior to the damage being repaired.

R328.5 Change of use or occupancy. A change of use or occupancy to one not within the scope of this code shall comply with the *International Existing Building Code*.

Commenter's Reason: In disapproving RB163, the IRC committee invited a modification by public comment. The committee's reason, in its entirety, said, "This proposal adds language that duplicates existing text. Please come back with a public comment that addresses this." The "existing text" referenced by the committee is in IRC Section R102.7.1. That section refers to whole buildings and structures. This PC eliminates any duplication by referring only to existing structural elements -- in exactly the same way that current Sections N1107 through N1111 address existing conditions with regard to energy efficiency, Section M1202 addresses existing mechanical systems, and Section P2502 addresses existing plumbing systems.

The PC also makes a number of clarifications, simplifications, and minor corrections to the original RB163 text, but otherwise it shares the same reasoning: With the approval last cycle of IEBC Section 101.2 and the disapproval this cycle of proposal ADM7-19, ICC committees are confirming their intent that the IRC should be a code for existing dwellings and townhouses as well as new ones. To fulfill that purpose, the IRC needs some provisions to cover existing structural elements. Further, those provisions need to be more than a general statement in Chapter 1. The IRC should have a section for existing structural elements in Chapter 3, just as it has Sections N1107-N1111, M1202, and P2502 for energy efficiency, mechanical systems, and plumbing systems respectively.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As with the original proposal RB163, this version modified by public comment merely clarifies what we believe is the current intent of the code.

Public Comment# 2146

Public Comment 2:

IRC@: R102.7.1

Proponents:

Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R102.7.1 Additions, alterations or repairs. Additions, alterations or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with the requirements of this code, unless otherwise stated. Additions, alterations, repairs and relocations shall not cause an existing structure to become ~~unsafe or adversely affect the performance of the building.~~ less compliant with the provisions of this code than the existing building or structure was prior to the addition, alteration or repair. An existing building together with its additions shall comply with the height limits of this code. Where the alteration causes the use or occupancy to be changed to one not within the

scope of this code, the provisions of the International Existing Building Code shall apply.

Commenter's Reason: The original code change was proposed in chapter 3 and is completely replaced with a simpler proposal in chapter 1 or the IRC and more specifically Section R102.7.1. It also only references the IEBC when the occupancy changes to one not regulated by the IRC. We believe that the public comment addressed all the issues raised in the CAH.

- With recent changes to the IEBC (Sec 101.2) , all existing dwellings and townhouses are now eligible to use the IRC for any existing building project, but the only EB structural provisions in the IRC are in the Admin chapter (R102.7.1).
- If the IRC is now also going to function as an EB code, it needs some provisions for existing structural elements, just as it has provisions energy efficiency in existing buildings (Ch 11) and for existing mechanical systems (Ch 12), existing plumbing systems (Ch 25), and existing chimneys (Sec G2427.5.5).
- This proposal, as modified by public comment, updates Section 102.7.1. The proposed text does not change any of the intent of current Section R102.7.1, but it separates and clarifies that intent by project type.
- The public comment also simplifies and corrects some of the original proposal wording.

The committee's reason for initial disapproval, in its entirety, was as follows (referencing Section R102.7.1): "This proposal adds language that duplicates existing text. Please come back with a public comment that addresses this. (Vote: 10-1)". But a review of the existing text in Section R102.7.1 shows that the proposal did not duplicate text in any way that creates a conflict. Nevertheless the committee's wishes have been fulfilled with this replacement.

Prior to the proposed modification to R102.7.1, the Section already says "unless otherwise stated," acknowledging that other provisions can be added without modifying or contradicting that section.

The proponent requests approval by way of public comment # 1, we require 2/3 of the voting majority for the online governmental vote to pass this code change please vote in support of this public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction This code change correlates the IRC with the IEBC, does not make technical changes, and thus does not increase or decrease construction costs.

Public Comment# 1316

RB164-19

IRC@: TABLE R403.1(1), TABLE R403.1(2), TABLE R403.1(3), R403.1.1

Proposed Change as Submitted

Proponents: Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

Revise as follows:

TABLE R403.1(1)

MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)^{a, b, c, d}

Portions of table not shown remain unchanged.

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf roof live load or 25 psf ground snow load	1 storyslab-on-grade	12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	12 6	12 6	12 6	12 6	12 6	12 6
	1 storyplus basement	16 18 6	12 14 6	12 6	12 6	12 6	12 6
	2 storyslab-on-grade	13 12 6	12 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	15 16 6	12 6	12 6	12 6	12 6	12 6
	2 storyplus basement	19 22 6	14 16 6	12 13 6	12 6	12 6	12 6
	3 storyslab-on-grade	16 14 6	12 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	18 x 6 19 6	14 6	12 6	12 6	12 6	12 6
	3 storyplus basement	22 x 7 25 8	16 19 6	13 15 6	12 13 6	12 6	12 6
30 psf	1 storyslab-on-grade	12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	13 6	12 6	12 6	12 6	12 6	12 6
	1 storyplus basement	16 19 6	12 14 6	12 6	12 6	12 6	12 6
	2 storyslab-on-grade	13 12 6	12 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	16 17 6	12 13 6	12 6	12 6	12 6	12 6
	2 storyplus basement	19 23 6	14 17 6	12 14 6	12 6	12 6	12 6
	3 storyslab-on-grade	16 15 6	14 12 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	19 x 20 6	14 15 6	12 6	12 6	12 6	12 6
	3 storyplus basement	22 x 7 26 8	16 20 6	13 16 6	12 13 6	12 6	12 6
50 psf	1 storyslab-on-grade	12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	14 16 6	12 6	12 6	12 6	12 6	12 6
	1 storyplus basement	18 21 6	13 16 6	12 13 6	12 6	12 6	12 6
	2 storyslab-on-grade	15 14 6	13 12 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	17 19 6	13 14 6	12 6	12 6	12 6	12 6
	2 storyplus basement	21 25 7	15 19 6	12 15 6	12 6	12 6	12 6
	3 storyslab-on-grade	18 17 6	13 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	20 22 6	15 17 6	12 13 6	12 6	12 6	12 6
	3 storyplus basement	24 x 8 28 9	18 21 6	14 17 6	12 14 6	12 6	12 6
	1 storyslab-on-grade	14 12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	16 18 6	12 13 6	12 6	12 6	12 6	12 6
	1 storyplus basement	19 x 624 7	14 18 6	12 14 6	12 6	12 6	12 6

70 psf	2 storyslab-on-grade	17 16 6	12 6	6	6	12 6	12 6	12 6
	2 storywith crawl space	19 21 6	14 16 6	12 13 6	12 6	12 6	12 6	12 6
	2 storyplus basement	22 x 7 27 9	17 20 6	13 16 6	12 14 6	12 6	12 6	12 6
	3 storyslab-on-grade	20 x 6 19 6	15 14 6	12 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	22 25 7	16 18 6	13 15 6	12 6	12 6	12 6	12 6
	3 storyplus basement	24 x 8 30 4	19 23 6	15 18 6	13 15 6	12 13 6	12 6	12 6

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m².

a. ~~Interpolation allowed:~~ Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is ~~not allowed:~~ permitted.

b. ~~Based on 32-foot wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick). The table is based on the following conditions and loads: Building width: 32 feet; Wall height: 9 feet; Basement wall height: 8 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; Live loads: Roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.~~

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width.

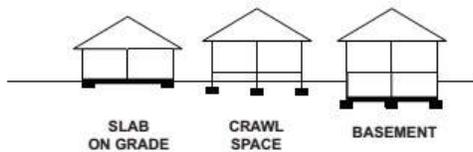


TABLE R403.1(2)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION WITH BRICK VENEER OR LATH
AND PLASTER (inches)^{a, b, c, d}

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH BRICK VENEER	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf roof live load or 25 psf ground snow load	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	1824 × 6	1415 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	1815 × 6	1312 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	2326 × 8	1720 × 6	1416 × 6	1213 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	23 × 820 × 6	1715 × 6	1412 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	25 × 926 × 8	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—plus basement	2932 × 11	2124 × 7	1719 × 6	1416 × 6	1214 × 6	12 × 6
30 psf	1 story—slab-on-grade	1312 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	1516 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	1822 × 6	1416 × 6	1213 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	1816 × 6	1412 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	2022 × 6	1516 × 6	1213 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	24 × 827 × 9	1821 × 6	1416 × 6	1214 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	23 × 821 × 6	1816 × 6	1413 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	26 × 927 × 8	1920 × 6	1516 × 6	13 × 6	12 × 6	12 × 6
	3 story—plus basement	2933 × 11	2224 × 7	1720 × 6	1416 × 6	1214 × 6	12 × 6
50 psf	1 story—slab-on-grade	1413 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	1718 × 6	1314 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	20 × 624 × 7	1518 × 6	1214 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	2018 × 6	1514 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	2224 × 7	1718 × 6	1314 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	25 × 929 × 10	1922 × 6	1518 × 6	1315 × 6	1213 × 6	12 × 6
	3 story—slab-on-grade	25 × 927 × 7	19 × 618 × 6	1513 × 6	1312 × 6	12 × 6	12 × 6
	3 story—with crawl space	27 × 1029 × 9	21 × 722 × 6	1617 × 6	14 × 6	12 × 6	12 × 6
	3 story—plus basement	3135 × 12	2326 × 8	1821 × 6	1517 × 6	1315 × 6	1213 × 6
	1 story—slab-on-grade	1415 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	1720 × 6	1415 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	22 × 726 × 8	1620 × 6	1316 × 6	1213 × 6	12 × 6	12 × 6

70 psf	2 story—slab-on grade	$\frac{21 \times 720}{6}$	1615×6	$\frac{1312}{6} \times 6$	12×6	12×6	12×6
	2 story—with crawl space	2426×8	1819×6	$\frac{1415}{6} \times 6$	$\frac{1213}{6} \times 6$	12×6	12×6
	2 story—plus basement	$\frac{27 \times 1032}{11}$	$\frac{20 \times 624}{7}$	$\frac{1619}{6} \times 6$	$\frac{1316}{6} \times 6$	$\frac{1214}{6} \times 6$	12×6
	3 story—slab-on-grade	$\frac{27 \times 1026}{8}$	2019×6	$\frac{1615}{6} \times 6$	13×6	12×6	12×6
	3 story—with crawl space	2931×11	2223×7	$\frac{1719}{6} \times 6$	$\frac{1516}{6} \times 6$	$\frac{1213}{6} \times 6$	12×6
	3 story—plus basement	$\frac{32 \times 1237}{13}$	$\frac{24 \times 828}{9}$	$\frac{1922}{6} \times 6$	$\frac{1618}{6} \times 6$	$\frac{1416}{6} \times 6$	$\frac{1214}{6} \times 6$

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m².

a. ~~Interpolation allowed.~~ Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not allowed. ~~permitted.~~

b. ~~Based on 32-foot wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick). The table is based on the following conditions and loads: Building width: 32 feet; Above-grade wall height: 9 feet; Slab-on-grade stem wall height: 1 foot; Crawlspace wall height: 4 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 45 psf wall assembly; Live loads: Roof and ground snow loads as listed, 10 psf attic floor; 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.~~

c. ~~Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.~~

d. ~~Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width.~~

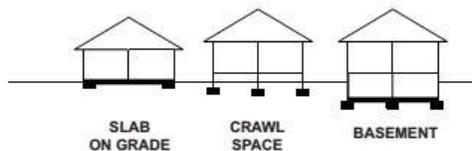


TABLE R403.1(3)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR FULLY-PARTIALLY GROUTED
MASONRY WALL CONSTRUCTION (inches)^{a, b, c, d}

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH CMU OR CONCRETE	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf roof live load or 25 psf ground snow load	1 story slab-on-grade	$\frac{13 \times 4}{6}$	12 6	12 6	12 6	12 6	12 6
	1 story with crawl space	$\frac{16 \times 9}{6}$	$\frac{12 \times 4}{6}$	12 6	12 6	12 6	12 6
	1 story plus basement	$\frac{19 \times 6}{8}$	$\frac{14 \times 9}{6}$	$\frac{12 \times 5}{6}$	$\frac{12 \times 3}{6}$	12 6	12 6
	2 story slab-on-grade	$\frac{19 \times 6}{7}$	$\frac{14 \times 8}{6}$	$\frac{12 \times 4}{6}$	12 6	12 6	12 6
	2 story with crawl space	$\frac{22 \times 7}{9}$	$\frac{16 \times 2}{6}$	$\frac{13 \times 7}{6}$	$\frac{12 \times 4}{6}$	12 6	12 6
	2 story plus basement	$\frac{25 \times 9}{12}$	$\frac{19 \times 6}{8}$	$\frac{15 \times 2}{6}$	$\frac{12 \times 7}{6}$	$\frac{12 \times 5}{6}$	$\frac{12 \times 3}{6}$
	3 story slab-on-grade	$\frac{25 \times 9}{11}$	$\frac{19 \times 6}{7}$	$\frac{15 \times 9}{6}$	$\frac{13 \times 6}{6}$	$\frac{12 \times 4}{6}$	12 6
	3 story with crawl space	$\frac{28 \times 10}{14}$	$\frac{21 \times 7}{9}$	$\frac{17 \times 3}{6}$	$\frac{14 \times 9}{6}$	$\frac{12 \times 6}{6}$	$\frac{12 \times 4}{6}$
	3 story plus basement	$\frac{31 \times 12}{17}$	$\frac{23 \times 8}{11}$	$\frac{18 \times 6}{8}$	$\frac{15 \times 2}{6}$	$\frac{13 \times 9}{6}$	$\frac{12 \times 6}{6}$
30 psf	1 story slab-on-grade	$\frac{13 \times 5}{6}$	12 6	12 6	12 6	12 6	12 6
	1 story with crawl space	$\frac{16 \times 2}{6}$	$\frac{12 \times 5}{6}$	12 6	12 6	12 6	12 6
	1 story plus basement	$\frac{19 \times 7}{8}$	$\frac{14 \times 2}{6}$	$\frac{12 \times 6}{6}$	$\frac{12 \times 3}{6}$	12 6	12 6
	2 story slab-on-grade	$\frac{19 \times 6}{7}$	$\frac{15 \times 8}{6}$	$\frac{12 \times 5}{6}$	12 6	12 6	12 6
	2 story with crawl space	$\frac{22 \times 7}{10}$	$\frac{16 \times 2}{6}$	$\frac{13 \times 8}{6}$	$\frac{12 \times 5}{6}$	$\frac{12 \times 3}{6}$	12 6
	2 story plus basement	$\frac{25 \times 9}{13}$	$\frac{19 \times 6}{8}$	$\frac{15 \times 2}{6}$	$\frac{13 \times 8}{6}$	$\frac{12 \times 5}{6}$	$\frac{12 \times 3}{6}$
	3 story slab-on-grade	$\frac{26 \times 9}{12}$	$\frac{19 \times 6}{7}$	$\frac{15 \times 2}{6}$	$\frac{13 \times 7}{6}$	$\frac{12 \times 4}{6}$	12 6
	3 story with crawl space	$\frac{28 \times 10}{14}$	$\frac{21 \times 7}{9}$	$\frac{17 \times 6}{7}$	$\frac{14 \times 9}{6}$	$\frac{12 \times 7}{6}$	$\frac{12 \times 4}{6}$
	3 story plus basement	$\frac{31 \times 12}{17}$	$\frac{23 \times 8}{12}$	$\frac{19 \times 6}{8}$	$\frac{16 \times 2}{6}$	$\frac{13 \times 9}{6}$	$\frac{12 \times 7}{6}$
50 psf	1 story slab-on-grade	$\frac{15 \times 7}{6}$	$\frac{12 \times 3}{6}$	12 6	12 6	12 6	12 6
	1 story with crawl space	$\frac{18 \times 2}{6}$	$\frac{13 \times 7}{6}$	$\frac{12 \times 3}{6}$	12 6	12 6	12 6
	1 story plus basement	$\frac{21 \times 7}{9}$	$\frac{16 \times 2}{6}$	$\frac{12 \times 7}{6}$	$\frac{12 \times 4}{6}$	12 6	12 6
	2 story slab-on-grade	$\frac{21 \times 7}{8}$	$\frac{16 \times 2}{6}$	$\frac{13 \times 6}{6}$	$\frac{12 \times 3}{6}$	12 6	12 6
	2 story with crawl space	$\frac{24 \times 8}{11}$	$\frac{18 \times 6}{7}$	$\frac{14 \times 9}{6}$	$\frac{12 \times 6}{6}$	$\frac{12 \times 4}{6}$	12 6
	2 story plus basement	$\frac{27 \times 10}{14}$	$\frac{20 \times 6}{9}$	$\frac{16 \times 3}{6}$	$\frac{13 \times 9}{6}$	$\frac{12 \times 6}{6}$	$\frac{12 \times 4}{6}$
	3 story slab-on-grade	$\frac{27 \times 10}{13}$	$\frac{20 \times 6}{8}$	$\frac{16 \times 2}{6}$	$\frac{14 \times 8}{6}$	$\frac{12 \times 5}{6}$	$\frac{12 \times 3}{6}$
	3 story with crawl space	$\frac{30 \times 11}{15}$	$\frac{22 \times 7}{10}$	$\frac{18 \times 6}{7}$	$\frac{15 \times 2}{6}$	$\frac{13 \times 7}{6}$	$\frac{12 \times 5}{6}$
	3 story plus basement	$\frac{33 \times 13}{17}$	$\frac{25 \times 9}{11}$	$\frac{20 \times 6}{8}$	$\frac{16 \times 2}{6}$	$\frac{14 \times 2}{6}$	$\frac{12 \times 7}{6}$

		18	12	9	6	6
70 psf	1 story slab-on-grade	17 1/2	13 1/4	12	12	12
	1 story with crawl space	19 x 6 2/5 7	14 1/8	12 1/5	12	12
	1 story plus basement	22 x 7 3/10 10	17 2/3	13 1/8	12 1/5	12 1/6
	2 story slab-on-grade	23 x 8 2/9 9	17 2/3	14 1/7	12 1/4	12
	2 story with crawl space	25 x 9 3/4 12	19 x 6 2/6 8	15 2/6	12 1/7	12 1/6
	2 story plus basement	28 x 10 4/10 15	21 x 7 3/10 10	17 x 6 2/4 7	14 2/6	12 1/7
	3 story slab-on-grade	29 x 11 3/8 14	22 x 7 2/8 9	17 2/3	14 1/6	12 1/6
	3 story with crawl space	31 x 12 4/10 16	23 x 8 3/10 11	19 x 6 2/6 8	16 2/6	13 1/8
	3 story plus basement	34 x 13 4/10 19	26 x 9 3/10 13	21 x 7 2/10 10	17 x 6 2/4	15 2/6

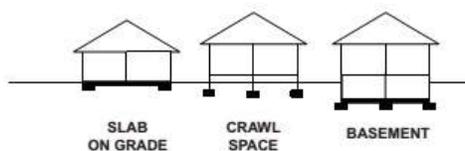
For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m².

a. ~~Interpolation allowed:~~ Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is ~~not allowed:~~ permitted.

b. ~~Based on 32-foot wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).~~ The table is based on the following conditions and loads: Building width: 32 feet; Above-grade wall height: 9 feet; Slab-on-grade stem wall height: 1 foot; Crawlspace wall height: 4 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 10 psf wall assembly; Live loads: Roof and ground snow loads as listed, 10 psf attic floor, 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width.



R403.1.1 Minimum size. The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) through R403.1(3) and Figure R403.1(1) or R403.1.3, as applicable but not less than 12 inches (305 mm) in width and 6 inches (152 mm) in depth. The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Footing projections, P, shall be not less than 2 inches (51 mm) and shall not exceed the thickness of the footing. Footing thickness and projection for fireplaces shall be in accordance with Section R1001.2. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3). Footings for precast foundations shall be in accordance with the details set forth in Section R403.4, Table R403.4, and Figures R403.4(1) and R403.4(2).

Reason: Builders using the new footing tables introduced in the 2015 IRC have found the footing widths required by the table are significantly larger than those required by previous editions of Table R403.1, which dated back to the CABO codes. In many cases they were wider than an engineering analysis would suggest. A careful review of the calculations underlying the 2015 IRC tables found a number of cases where load assumptions and determinations were overly conservative, and a few cases where the calculations were actually unconservative. Problems with the assumptions and calculations included the following:

- The original calculations apply the full ground snow load to the roof. The actual roof snow load per ASCE 7, unadjusted by any other factors, is 70% of the ground snow load or 20 pounds per square foot, whichever is greater. Consistent with the Chapter 8 rafter tables, a thermal factor

of 1.1 per ASCE 7 is applied to the calculation of the snow load.

- The original calculations apply a 100 pound per square foot weight for above-grade concrete or masonry walls, representing a solid or fully-grouted 8" CMU wall. Such walls are more likely to be either 8" CMU with reinforcing @ 48" o.c. or 8" insulated concrete forms, both of which have a 55 pound per square foot weight.
- The original calculations use only the ASCE 7 load combination that applies a 0.75 factor for concurrent roof/snow and floor live loads, ignoring the load combinations that apply just the roof/attic LL, just the snow load, or just the total floor live loads.
- The original calculations are based on tributary width, yet Footnote #2 adds 2 inches of footing width for every 2 feet of additional **building width**. As a result of confusing building and tributary width, the footnote adds twice as much footing width as is necessary based on the loads!

Other key changes in the revised code text and footing tables include:

- The original footnote allowing footing width and depth to be adjusted is converted into two footnotes. One footnote requires an increase in footing width and depth when the building width perpendicular to a wall footing exceeds 32 feet. The second footnote permits, but does not require, a decrease in footing width and depth for a building width of 32 feet or narrower.
- The charging text is revised to clarify the minimum width of a footing shall not be less than 12 inches and depth shall not be less than 6 inches. Previously, the limitation on depth was buried in a footnote.

These revised tables correct the inconsistencies in the load assumptions and calculations. The result in many cases is footing widths for one- and two-family dwellings that are more in line with historic practice, while still technically justified under engineering standards and accepted practices. However, it is noted there are cases for houses on weaker soils (1500 and 2000 psf soil bearing strength) as well as for slab-on-grade and crawlspace houses, where corrections to the calculations, the assumption of clear-spanning roof trusses, and other changes to the assumptions increase the loads sufficiently to increase the footing widths.

Cost Impact: The code change proposal will increase the cost of construction

The revised tables increase footing sizes and depths for houses on weaker soils and slab-on-grade or crawlspace houses due to the revised calculations imposing larger loads on the footings. In other cases, correcting overly conservative assumptions result in modest reductions in footing size. Also, this proposal improves clarity regarding the base assumptions, which may allow more dwellings to be constructed using the table rather than having to rely on engineered design or other, more conservative, engineering-based prescriptive standards, thus some builders may save on both footing size and avoid engineering design fees.

RB164-19

Public Hearing Results

Errata: This proposal includes unpublished errata
(No change to portions of tables and footnotes not shown)

TABLE R403.1(1) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)^{a, b, c, d}

(1st column, 2nd row) 20 psf roof live load or 25 psf ground snow load

TABLE R403.1(3) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)^{a, b, c, d}

b. The table is based on the following conditions and loads: Building width: 32 feet; Above-grade wall height: 9 feet; Slab-on-grade stem wall height: 1 foot; Crawlspace wall height: 4 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 10-100 psf wall assembly; Live loads: Roof and ground snow loads as listed, 10 psf attic floor, 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

Committee Action:

As Modified

Committee Modification:
(No change to portions of tables or footnotes not shown)

TABLE R403.1(1) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)^{a, b, c, d}

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (mm) and minimum depth is 6 inches (mm).

TABLE R403.1(2) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION WITH BRICK VENEER OR LATH AND PLASTER (inches)^{a, b, c, d}

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (mm) and minimum depth is 6 inches (mm).

TABLE R403.1(3) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)^{a, b, c, d}

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (mm) and minimum depth is 6 inches (mm).

Committee Reason: Three concrete footing tables are revised for coordination with ASCE 7 and to address bearing forces from trusses with outward thrust. This is a needed improvements for builders. The committee felt the calculations and loads used to determine these revisions were adequate. The reason for the modification removed some duplication and improved clarity. There is a errata for Table R403.1(1) in the first column and Table R403.1(3) in footnote b. (Vote: 9-2)

Assembly Action:

None

RB164-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephanie Young, representing National Council of Structural Engineers Associations (stephanie@mattsonmacdonald.com)

requests Disapprove

Commenter's Reason: The proponent states that the purpose of this Table is to allow the user of this Code to determine the required footing width for various scenarios within typical residential construction. Although we support the intent and general concept, the actual result of the approval of this particular Table would be an increase in the number of instances where an "engineered design" would be required.

As with all prescriptive designs, assumptions must be made with respect to loads, spans, and construction types. The assumptions made during the development of this Table are too limiting to help the typical end user.

In all of the following situations, the Table would not be applicable, resulting in the need for an "engineered design":

- Homes without a central bearing wall or supporting beam on all levels other than at the uppermost level.
- Homes with a bearing wall or supporting beam located anywhere but at the center of the structure.
- Roof structures which accommodate a current or future solar installation.
- Living spaces, other than "sleeping rooms", located on any floor above the main level.
- Living spaces or "sleeping rooms" located within the attic space.
- Floor assemblies with self-weight (dead load) greater than 10 psf.
 - Wood floor finishes would not be allowed
 - Tile floor finishes would not be allowed
 - Gypsum leveling material would not be allowed
 - Stone/granite and similar countertop materials would not be allowed
- Foundation wall heights greater than 8'-0"
- Foundation wall self-weights (dead load) greater than 120 psf

We are also concerned that the information contained in the footnotes is extremely important in determining the valid use of the Table and feel it will often be missed in the current location.

Since many of the scenarios listed above occur often in current construction, we would recommend the disapproval of this specific Table and suggest that the old Table be retained while a new Table is created which would be more universally applicable. Although the minimum footing width values will likely increase slightly, we feel that the expanded coverage of conditions would ultimately benefit a wider audience of users.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1847

RB166-19

IRC@: R403.1.6, R404.1.3.3.6

Proposed Change as Submitted

Proponents: Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

2018 International Residential Code

Revise as follows:

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum 1/2-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to 1/2-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be located after the concrete is placed and before it has set in accordance with ACI 332.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

R404.1.3.3.6 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other *approved* material suitable for supporting and containing concrete. Forms shall be accurately positioned and secured before placing concrete and shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

Reason: ACI 332 Residential Code Requirements for Structural Concrete and Commentary is a standard used for residential concrete construction. Many residential foundation installations include "wet-set" anchor bolts to attach wood sills to foundations. This code change will codify a common practice that is not recognized as an accepted practice in ACI 318 Building Code Requirements for Structural Concrete and Commentary but is allowed in ACI 332. In some cases, "wet-setting" the anchor bolt is the only method by which the bolt can be placed. Insulated concrete forms (ICF's) as well as Concrete Masonry Units (CMU) allow this type of installation. The code change is limited to the wet setting of the anchor bolt connection to the wood sill. Forms that are to be embedded would need to be tied down or secured prior to the concrete pour.

Cost Impact: The code change proposal will decrease the cost of construction
It will reduce the labor and time in foundation construction in one and two family dwellings.

RB166-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that this method to install anchor bolts needed to address consolidation. ACI 332 does not address this application. (Vote: 7-4)

Individual Consideration Agenda

Public Comment 1:

IRC@: R404.1.3.3.6, R403.1.6

Proponents:

Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R404.1.3.3.6 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other *approved* material suitable for supporting and containing concrete. Forms shall be ~~accurately~~ positioned and secured before placing concrete and shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum $\frac{1}{2}$ -inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to $\frac{1}{2}$ -inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be permitted to be located after the while concrete is placed still plastic and before it has set in accordance with ACI 332. Where anchor bolts resist placement or the consolidation of concrete around anchor bolts is impeded, the concrete shall be vibrated to ensure full contact between the anchor bolts and concrete.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

Commenter's Reason: This public comment is being proposed by the proponent of the code change. During the Committee Action Hearings (CAH), concerns were expressed about the practice of wet setting anchor bolts and the consolidation of concrete around bolts. Voids can form in concrete not in full contact with the bolt. A requirement to vibrate the concrete where the concrete's plasticity is in question has been included and should address this concern.

The word "accurately" has been removed from the proposed language in R404.1.3.3.6 referring to the positioning of forms because it is subjective; a contractor or inspector might have a completely different opinion about the meaning of "accurate".

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. Allowing the wet-setting of anchor bolts will decrease the labor needed to secure anchor bolts prior to concrete placement. The requirement added in the public comment to vibrate the concrete if it is losing its plasticity, might result in a small decrease the labor savings initially gained by allowing wet-setting.

Public Comment# 1243

RB174-19

IRC@: R406.2

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Residential Code

Revise as follows:

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be waterproofed from the higher of (a) the top of the footing or (b) 6 inches (152 mm) below the top of the basement floor, to the finished *grade*. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Six-mil (0.15 mm) polyvinyl chloride.
4. Six-mil (0.15 mm) polyethylene.
5. Forty-mil (1 mm) polymer-modified asphalt.
6. Sixty-mil (1.5 mm) flexible polymer cement.
7. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. Sixty-mil (1.5 mm) solvent-free liquid-applied synthetic rubber.
9. A drainage layer of not less than 4 inches (102 mm) of free draining granular material.
10. A drainage layer that provides equivalent performance to not less than 4 inches (102 mm) of free draining granular material.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and parings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D449. Hot asphalt shall be applied at a temperature of less than 200° F (93° C).

Reason: Obejective:

Provide more options for foundations waterproofing and dampproofing.

This code change provides additional options for foundation waterproofing and dampproofing.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This provides additional options. Options seldom add costs and sometimes can reduce costs.

RB174-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee felt that the proposed addition would be more appropriate in Section R405. This could be addressed in an evaluation report; or equivalent performance is allowed by comparisons to Items 1 through 8. Item 9 could be an issue for drainage versus water proofing over the long term. (Vote: 11-0)

Assembly Action:

None

RB174-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R406.2

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be waterproofed from the higher of (a) the top of the footing or (b) 6 inches (152 mm) below the top of the basement floor, to the finished *grade*. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Six-mil (0.15 mm) polyvinyl chloride.
4. Six-mil (0.15 mm) polyethylene.
5. Forty-mil (1 mm) polymer-modified asphalt.
6. Sixty-mil (1.5 mm) flexible polymer cement.
7. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. Sixty-mil (1.5 mm) solvent-free liquid-applied synthetic rubber.
9. A drainage layer of not less than 4 inches (102 mm) of free draining granular material having a void ratio of not less than 35 percent or a Size Number 4.5, 56, or 6 as classified by ASTM C33.
10. A drainage layer that provides equivalent performance to not less than 4 inches (102 mm) of free draining granular material having a void ratio of not less than 35 percent or a Size Number 4.5, 56, or 6 as classified by ASTM C33.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and parings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D449. Hot asphalt shall be applied at a temperature of less than 200° F (93° C).

Commenter's Reason: Committee reason is incorrect. In general drainage is a substitute for waterproofing and is recognized as such in the international codes. Also needs this modification to be consistent with S113.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change does not change costs. It provides alternative means and methods of construction.

Public Comment# 1935

RB182-19

IRC: R506.1, CHAPTER 44 PTI (New)

Proposed Change as Submitted

Proponents: Amy Dowell, representing Post-Tensioning Institute (amy.dowell@post-tensioning.org); Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

2018 International Residential Code

Revise as follows:

R506.1 General. Concrete slab-on-ground floors, other than post-tensioned slab-on-ground floors, shall be designed and constructed in accordance with the provisions of this section or ACI 332. ~~Floors~~ Such floors shall be a minimum 3¹/₂ inches (89 mm) thick (for expansive soils, see Section R403.1.8). Post-tensioned concrete slabs-on-ground floors placed on expansive or stable soils shall be designed and constructed in accordance with PTI DC—10.5. The specified compressive strength of concrete shall be as set forth in Section R402.2.

Add new standard(s) as follows:

PTI

Post-Tensioning Institute
38800 Country Club Drive
Farmington Hills MI 48331
US

DC—10.5-12: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils

Reason: There are currently no provisions for designing post-tensioned slabs on expansive or stable soils in IRC. This proposal includes a new reference to PTI standard PTI DC10.5-19, Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils.

Post-tensioned slabs are commonly used on stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Additional documentation can be viewed at http://ww2.post-tensioning.org/PDF_FILES/190102-DC10.5-Expansive and Stable Soils-Public Review.pdf.

Bibliography: .

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Post-tensioned slabs are commonly used on expansive and stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Staff Analysis: The referenced standard, PTI-DC-10.5-12, is currently referenced in other 2018 I-codes.

RB182-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The reference to PTI in the proposed requirement uses "constructed". PTI DC 10-5 is a design standard, not a construction standard. There are significant changes between the 2012 and the 2019 edition of this standard. Stable soils are not addressed in the 2012, but will be in the 2019. Once this new edition is finished, then a reference would be appropriate to reconsider. (Vote: 10-1)

Assembly Action:

None

RB182-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R506.1, PTI (New)

Proponents:

Amy Dowell, Post-Tensioning Institute, representing Post-Tensioning Institute (amy.dowell@post-tensioning.org); Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R506.1 General. Concrete slab-on-ground floors, other than post-tensioned slab-on-ground floors, shall be designed and constructed in accordance with the provisions of this section or ACI 332. Such floors shall be a minimum 3¹/₂ inches (89 mm) thick (for expansive soils, see Section R403.1.8). Post-tensioned concrete slabs-on-ground floors placed on expansive or stable soils shall be designed ~~and constructed~~ in accordance with PTI DC—10.5. The specified compressive strength of concrete shall be as set forth in Section R402.2.

PTI

Post-Tensioning Institute
38800 Country Club Drive
Farmington Hills MI 48331
US

DC—10.5-~~12~~-19: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils

Commenter's Reason: We agree with the committee and the phrase " and constructed" was removed from the proposal because the PTI DC10.5-19 Standard does not cover construction.

PTI DC10.5-19: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils has completed the consensus process and been published.

PTI DC10.5 is already referenced in IBC and is on the consent agenda for an administrative update to reference this new version published in 2019

Bibliography: PTI DC10.5-19: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils https://www.post-tensioning.org/publications/store/productdetail.aspx?ItemID=DC105&Language=English&Units=US_AND_METRIC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Post-tensioned slabs are commonly used on expansive and stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Public Comment# 1774

RB183-19

IRC@: R506.2.3, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Terry Kozlowski, representing Southern Nevada Chapter; Amanda Moss, representing SN-ICC Member; Cassidy Wilson, representing SN-ICC Member; Nenad Mirkovic, representing City of Las Vegas

2018 International Residential Code

Revise as follows:

R506.2.3 Vapor retarder. A ~~6-mil (0.006-10-mil (0.010 inch; 152- μ m) 0.254 mm)~~ polyethylene or *approved* vapor retarder conforming to ASTM E 1745 Class A requirements with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports.
3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

Reason: By coordinating the requirements for the vapor retarder with the American Concrete Institute (ACI) recommendations, this proposal will promote consistency across codes and standards for various moisture conditions.

Bibliography: ACI 302.2R Section 9.3:

"...ACI 302.1R recommends a minimum 10 mil (0.25 mm) vapor retarder thickness when the retarder is protected with a granular fill. When the vapor retarder is not protected by a fill, some specifiers require a 15 mil (0.38 mm) thickness or greater..."

Cost Impact: The code change proposal will increase the cost of construction

This proposal will increase the cost of construction for an average 2,200 square foot single-family dwelling by an estimated \$28.60, based on cost analysis in current market conditions.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E1745-17, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB183-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R506.2.3 Vapor retarder. A minimum 10-mil (0.010 inch; 0.254 mm) ~~polyethylene or approved~~ vapor retarder conforming to ASTM E 1745 Class A requirements with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports.

3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

Committee Reason: The modification was approved because adding "minimum" adds clarity to the requirements; and polyethylene was removed because all products can meet the standard. There is not the need to call out one product. The proposal was approved because the language would be in line with the concrete industry guidelines. The 6 mil was increased to 10 mill because the 6 mil products have not proved to be durable enough. The referenced standard would increase options. (Vote: 6-5)

Assembly Action:

None

RB183-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R506.2.3

Proponents:

Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R506.2.3 Vapor retarder. A minimum ~~10~~ 6-mil (0.010 0.006 inch; ~~0.254 mm~~ 152 μ m) vapor retarder conforming to ASTM E1745 ~~Class A requirements~~ and with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports.
3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

Commenter's Reason: This code change proposal reduces the minimum thickness from 10 mil to 6 mil and reduces the specified class of materials conforming to ASTM E1745 from Class A to Class C.

These changes are intended to better align the provisions in the IRC with the recommendations of ACI Committee 302 on Construction of Concrete Floors as published in ACI 302.2R Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials which reads: "In the past, 4, 6, 8, and 10 mil (0.10, 0.15, 0.20, and 0.25 mm) low-density polyethylene sheets have been used as belowslab vapor retarder material. Any material used as a belowslab vapor retarder/barrier, however, should conform to the requirements of ASTM E 1745, 'Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.'"

Since ACI 302.2R does not specify class, this public comment reduces the class to the minimum requirements of ASTM E1745 which is Class C.

Since ACI 302.2R does not specify thickness, as long as the material satisfies ASTM E1745 it would be preferable to not specify minimum thickness in the IRC. However, during the Committee Action Hearings arguments were made that 1) 6 mil polyethylene sheet is not sufficiently durable for applications as belowslab vapor retarders and 2) a minimum thickness should be specified since the IRC is intended to be prescriptive. ASTM E1745 does not specify materials and thus arguments made that 6 mil polyethylene sheet might not be sufficiently durable may not be applicable to 6 mil-thick membranes made of other materials. Since 6 mil was permitted in the 2018 IRC, this public comment reverts back to that as the minimum thickness.

Bibliography: 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. By limiting the criteria of this provision to any material conforming to ASTM E1745 and allowing minimum thickness of 6 mil, this provision should

not significantly increase the cost of construction as compared to the 2018 edition of the IRC, but could reduce costs compared to the the new provision presented as RB183-19.

Public Comment# 1250

Public Comment 2:

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests Disapprove

Commenter's Reason: The proposed code change, if approved for the 2021 IRC, would limit product choice and increase cost by requiring the use of a proprietary underslab vapor retarder product as opposed to generic polyethylene sheet.

No technical data was provided that this change is necessary for houses. ACI 302.1R is a guide intended for slabs in industrial, commercial, and institutional buildings. No mention of houses is made anywhere in ACI 302.1R.

ACI 302.2R is a guide specific to moisture-sensitive flooring materials. Many common floor coverings used in houses are permeable or semi-permeable or do not rely on water-borne adhesives. They are not susceptible to trapping moisture coming up from the slab and thus do not need the protection of a thick, proprietary vapor retarder.

Section 5.2.3.1 of ACI 302.1R-2015 recommends vapor retarders comply with ASTM E1745 but does not specify a minimum thickness. Section 7.1.1 of ACI 302.2R-2006 contains equivalent language. ASTM E1745 itself merely defines the three classes of vapor retarders (Class A, Class B and Class C) with the associated performance specs for each class, but does not associate the three classes with particular uses or product thicknesses. While the 1996 and 2004 editions of ACI 302.1R did recommend a 10 mil thickness, that recommendation was removed in the current 2015 edition.

Even if one accepts the ACI recommendation that vapor retarders comply with ASTM E1745 is applicable to houses, ACI 302.1R and 302.2R do not recommend a specific class, nor has the proponent provided any substantiation as to why the most stringent class of underslab vapor retarder material is necessary in all cases.

The proponents underestimate the cost of going from generic 6 mil polyethylene to a proprietary 10 mil product. The material cost increase is on the order of \$100 to \$300 for a typical house depending on the product used and the size of the home, plus there is an additional cost due to the added labor needed to carry and install the heavier rolls of material.

It is noted a similar proposal last cycle was rejected 10-1 by the IRC-Building committee and 259-23 by ICC's governmental voting representatives during the Online Governmental Consensus Vote. RB183 only passed the IRC-Building committee by a single vote, showing there was not an overwhelming consensus this requirement was necessary as a new minimum standard for all houses and conditions. The IRC is a minimum code, and therefore this code change should be disapproved.

Bibliography: American Concrete Institute, 2015. *Guide to Concrete Floor and Slab Construction*, ACI 301.2R-15, ACI, Farmington Hills, MI. American Concrete Institute, 2006. *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials*, ACI 302.2R-06, ACI, Farmington Hills, MI.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1212

RB184-19

IRC: R507.1, TABLE R507.3.1, R507.4, TABLE R507.4, R507.5, TABLE R507.5, TABLE R507.5(2) (New), TABLE R507.5(3) (New), TABLE R507.5(4) (New), R507.6, TABLE R507.6, TABLE R507.9.1.3(1)

Proposed Change as Submitted

Proponents: Deck Code Coalition, Charles Bajnai (chair), North American Deck and Railing Assoc (NADRA), Retired from Chesterfield County, VA, representing Deck Code Coalition (csbajnai@gmail.com)

2018 International Residential Code

Revise as follows:

R507.1 Decks. Wood-framed decks shall be in accordance with this section. Decks shall be designed for the live load required in Section R301.5 or the ground snow load indicated in Table R301.2(1), whichever is greater. For decks using materials and conditions not prescribed in this section, refer to Section R301.

**TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS**

LIVE OR GROUND SNOW LOAD ^b (psf)	TRIBUTARY AREA ^a (sq. ft.)	SOIL BEARING CAPACITY ^{a, c, d}											
		1500 psf			2000 psf			2600 ^e			≥ 3000 psf		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness f (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness f (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness f (inches)
40	5	Z	B	6	Z	B	6	Z	B	6			
	20	42 10	44 10	6	42 9	44 9	6	42	44	6	42 7	44 8	6
	40	14	46 14	6 7	12	44 13	6	42	44	6	42 10	44 10	6
	60	17	49 18	6 9	15	47 15	6 8	43	45	6	12	44 13	6
	80	20	22	7	17	19	6	45	47	6	14	16	6
	100	22	25	8	19	21	6	47	49	6	15	17	6
	120	24	27	9	21	23	7	49	51	6	17	19	6
	140	26	29	10	22	25	8	50	53	7	18	21	6
160	28	31	11	24	27	9	51	54	8	20	22	7	
50	5	Z	B	6	Z	B	6	Z	B	6			
	20	42 11	44 12	6	42 10	44 10	6	42	44	6	42 8	44 8	6
	40	48 16	47 16	6	43 8	45 14	6	42	44	6	42 11	44 12	6
	60	19	21	6	16	18	6	44	46	6	13	15	6
	80	21	24	8	19	21	6	47	49	6	15	17	6
	100	24	27	9	21	23	7	49	51	6	17	19	6
	120	26	30	10	23	25	8	50	53	7	19	21	6
	140	28	32	11	25	28	9	52	56	8	20	23	7
160	30	34	12	26	30	10	54	57	9	21	24	8	
60	5	Z	B	6	Z	B	6	Z	B	6			
	20	12	44 13	6	42 11	44 11	6	42	44	6	42 9	44 9	6
	40	46 17	49 18	6	44 15	46 15	6 8	43	44	6	12	44 13	6
	60	20	23	7	17	20	6	45	48	6	14	16	6
	80	23	26	9	20	23	7	48	50	6	15	19	6
	100	26	29	10	22	25	8	50	53	7	18	21	6
	120	28	32	11	25	28	9	52	56	8	20	23	7
	140	31	35	12	27	30	10	54	57	9	22	24	8
160	33	37	13	28	32	11	56	59	10	23	26	9	

70	5	Z	8	6	Z	8	6	Z	8	6	Z	8	6	Z	8	6	
	20	12	13	14	6	7	12	11	14	12	6	12	14	6	12	14	6
	40	18	19	20	9	16	17	18	19	20	21	22	23	24	25	26	27
	60	21	24	26	11	21	21	22	23	24	25	26	27	28	29	30	31
	80	25	28	31	13	25	24	25	26	27	28	29	30	31	32	33	34
	100	28	31	34	15	28	27	28	29	30	31	32	33	34	35	36	37
	120	30	34	37	17	30	29	30	31	32	33	34	35	36	37	38	39
	140	33	37	40	19	33	32	33	34	35	36	37	38	39	40	41	42
160	35	40	44	21	35	34	35	36	37	38	39	40	41	42	43	44	

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted, extrapolation not permitted.

b. Based on highest load case: Dead + Live or Dead + Snow.

c. ~~Assumes minimum square footing to be 12 inches x 12 inches x 6 inches for 6 x 6 post~~ Footing dimensions shall allow complete bearing of the post.

d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.

e. Area, in square feet, of deck surface supported by post and footings.

f. Minimum thickness shall only apply to plain concrete footings.

R507.4 Deck posts. For single-level wood framed decks with beams sized in accordance with Table R507.5, wood deck post size shall be in accordance with Table R507.4.

Delete and substitute as follows:

**TABLE R507.4
DECK POST HEIGHT^a**

DECK POST SIZE	MAXIMUM HEIGHT^{a, b} (feet-inches)
4 x 4	6-9 ^c
4 x 6	8
6 x 6	14
8 x 8	14

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Measured to the underside of the beam.

b. Based on 40 psf live load.

c. The maximum permitted height is 8 feet for one-ply and two-ply beams. The maximum permitted height for three-ply beams on post cap is 6 feet 9 inches.

**TABLE R507.4
DECK POST HEIGHT**

LOADS ^b (psf)	POST SPECIES ^e	POST SIZE ^d	TRIBUTARY AREA ^{g,h} (sqft)							
			20	40	60	80	100	120	140	160
			MAXIMUM DECK POST HEIGHT ^a (feet-inches)							
40 Live Load	Southern Pine	4 x 4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2
		4 x 6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2
		6 x 6	14-0	14-0	11-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir ^{e1}	4 x 4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3
		4 x 6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10
	Hem-fir ^{e1}	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	SPF ^e	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood ^{f1}	4 x 4	14-0	12-1	9-8	8-22	7-1	6-2	5-3	4-2
		4 x 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
	Western Cedars ^{f1}	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
Ponderosa Pine ^{f1}	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
50 Ground Snow Load	Southern Pine	4 x 4	14-0	12-2	9-10	8-5	7-5	9-7	5-11	5-4
		4 x 6	14-0	14-0	12-6	10-9	9-6	8-7	7-10	7-3
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	13-4
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir ^{e1}	4 x 4	14-0	12-1	9-8	8-2	7-1	6-2	5-3	4-2
		4 x 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11
	Hem-fir ^{e1}	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
	SPF ^e	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood ^{f1}	4 x 4	14-0	11-8	9-0	6-10	3-7	NP	NP	NP
		4 x 6	14-0	14-0	12-0	10-0	8-6	7-0	5-3	NP
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4
	Western Cedars ^{f1}	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4
Ponderosa Pine ^{f1}	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Southern Pine	4 x 4	14-0	11-1	8-11	7-7	6-7	5-10	5-2	4-6	
	4 x 6	14-0	14-0	11-4	9-9	8-7	7-9	7-1	6-6	
	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-9	11-2	
	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	

LOADS	POST SPECIES	POST SIZE	TRIBUTARY AREA (sqft)								
			20	40	60	80	100	120	140	160	
			MAXIMUM DECK POST HEIGHT (feet-inches)								
60(psf) Ground											
Snow Load	Douglas Fir ^e	4 x 4	14-0	10-11	8-8	7-3	6-2	5-0	3-7	NP	
		4 x 6	14-0	13-11	11-2	9-7	8-4	7-5	6-8	5-11	
	Hem-fir ^e	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-2	10-2	
		SPF ^e	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	Redwood ^f	4 x 4	14-0	10-6	7-9	4-7	NP	NP	NP	NP	
		4 x 6	14-0	13-7	10-9	8-9	7-0	4-9	NP	NP	
	Western Cedars ^f	6 x 6	14-0	14-0	14-0	14-0	14-0	9-9	NP	NP	
		Ponderosa Pine ^f	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	Red Pine ^f	4 x 4	14-0	10-2	8-2	6-11	5-11	5-2	4-4	3-4	
		4 x 6	14-0	12-11	10-5	8-11	7-10	7-1	6-5	5-10	
	70 Ground Snow Load	Southern Pine	6 x 6	14-0	14-0	14-0	14-0	14-0	12-9	10-11	8-7
			8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		Douglas Fir ^e	4 x 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP
			4 x 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11
		Hem-fir ^e	6 x 6	14-0	14-0	14-0	14-0	14-0	12-2	9-9	5-9
SPF ^e			8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Redwood ^f		4 x 4	14-0	9-5	6-5	NP	NP	NP	NP	NP	
		4 x 6	14-0	12-6	9-8	7-7	5-3	NP	NP	NP	
Western Cedars ^f		6 x 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP	
		Ponderosa Pine ^f	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Red Pine ^f		4 x 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP	
		4 x 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa., NP = Not Permitted

- a. Measured from the underside of the beam to top of footing or pier.
- b. 10 psf dead load. Snow load not assumed to be concurrent with live load.
- c. No. 2 grade, wet service factor included.
- d. Notched deck posts shall be sized to accommodate beam size per in accordance with Section R507.5.2
- e. Includes incising factor.
- f. Incising factor not included.
- g. Area, in square feet, of deck surface supported by post and footings.

h. Interpolation permitted. Extrapolation not permitted.

Revise as follows:

R507.5 Deck Beams. Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with ~~Table R507.5.~~ Tables R507.5(1) through R507(4). Beam plies shall be fastened with two rows of 10d (3-inch × 0.128-inch) nails minimum at 16 inches (406 mm) on center along each edge. Beams shall be permitted to cantilever at each end up to one-fourth of the allowable beam span. Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.

Delete and substitute as follows:

**TABLE R507.5
DECK BEAM SPAN LENGTHS^{a,b,c} (feet – inches)**

SPECIES ^e	SIZE ^d	DECK JOIST SPAN LESS THAN OR EQUAL TO:(feet)						
		6	8	10	12	14	16	18
Southern pine	1–2 x 6	4-11	4-0	3-7	3-3	3-0	2-10	2-8
	1–2 x 8	5-11	5-1	4-7	4-2	2-10	3-7	3-5
	1–2 x 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1–2 x 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2–2 x 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2–2 x 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2–2 x 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2–2 x 12	12-2	10-7	9-5	8-7	8-0	7-6	7-0
	3–2 x 6	8-2	7-5	6-8	6-1	5-8	5-3	5-0
	3–2 x 8	10-10	9-6	8-6	7-9	7-2	6-8	6-4
	3–2 x 10	13-0	11-3	10-0	9-2	8-6	7-11	7-6
3–2 x 12	15-3	13-3	11-10	10-9	10-0	9-4	8-10	
Douglas fir-larch ^e , hem-fir ^e , spruce-pine fir ^e , redwood, western cedars, ponderosa pine ^f , red pine ^f	3 x 6 or 2–2 x 6	5-5	4-8	4-2	3-10	3-6	3-1	2-9
	3 x 8 or 2–2 x 8	6-10	5-11	5-4	4-10	4-6	4-1	3-8
	3 x 10 or 2–2 x 10	8-4	7-3	6-6	5-11	5-6	5-1	4-8
	3 x 12 or 2–2 x 12	9-8	8-5	7-6	6-10	6-4	5-11	5-7
	4 x 6	6-5	5-6	4-11	4-6	4-2	3-11	3-8
	4 x 8	8-5	7-3	6-6	5-11	5-6	5-2	4-10
	4 x 10	9-11	8-7	7-8	7-0	6-6	6-1	5-8
	4 x 12	11-5	9-11	8-10	8-1	7-6	7-0	6-7
	3–2 x 6	7-4	6-8	6-0	5-6	5-1	4-9	4-6
	3–2 x 8	9-8	8-6	7-7	6-11	6-5	6-0	5-8
	3–2 x 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
3–2 x 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

- a. Ground snow load, live load = 40 psf, dead load = 10 psf, L/A = 360 at main span, L/A = 180 at cantilever with a 220-pound point load applied at the end.
- b. Beams supporting deck joists from one side only.
- c. No. 2 grade, wet service factor.
- d. Beam depth shall be greater than or equal to depth of joists with a flush beam condition.
- e. Includes incising factor.
- f. Northern species. Incising factor not included.
- g. Beam cantilevers are limited to the adjacent beam's span divided by 4.

TABLE R507.5(1)
MAXIMUM DECK BEAM SPAN LENGTHS^{a,b,g}(feet - inches) - 40 PSF LIVE LOAD^c

BEAM SPECIES^{e,d}	BEAM SIZE^{d,e}	DECK JOIST SPAN^{a,i}						
		LESS THAN OR EQUAL TO:						
		(feet)						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN^{a,b,f}						
		(feet -inches)						
Southern p Pine	<u>1-2 x 6</u>	<u>4-11</u> <u>4-7</u>	<u>4-0</u>	<u>3-7</u>	<u>3-3</u>	<u>3-0</u>	<u>2-10</u>	<u>2-8</u> <u>2-7</u>
	<u>1-2 x 8</u>	<u>5-11</u> <u>5-10</u>	<u>5-1</u>	<u>4-7</u> <u>4-6</u>	<u>4-2</u> <u>4-1</u>	<u>2-10</u> <u>3-10</u>	<u>3-7</u>	<u>3-5</u> <u>3-4</u>
	<u>1-2 x 10</u>	<u>7-0</u> <u>6-11</u>	<u>6-0</u>	<u>5-5</u> <u>5-4</u>	<u>4-11</u>	<u>4-7</u> <u>4-6</u>	<u>4-3</u>	<u>4-0</u>
	<u>1-2 x 12</u>	<u>8-3</u> <u>8-2</u>	<u>7-1</u>	<u>6-4</u>	<u>5-10</u> <u>5-9</u>	<u>5-5</u> <u>5-4</u>	<u>5-0</u>	<u>4-9</u> <u>4-8</u>
	<u>2-2 x 6</u>	<u>6-11</u> <u>6-10</u>	<u>5-11</u>	<u>5-4</u> <u>5-3</u>	<u>4-10</u>	<u>4-6</u>	<u>4-3</u> <u>4-2</u>	<u>4-0</u> <u>3-11</u>
	<u>2-2 x 8</u>	<u>8-9</u> <u>8-8</u>	<u>7-7</u> <u>7-6</u>	<u>6-9</u>	<u>6-2</u>	<u>5-9</u> <u>5-8</u>	<u>5-4</u>	<u>5-0</u>
	<u>2-2 x 10</u>	<u>10-4</u>	<u>9-0</u> <u>8-11</u>	<u>8-0</u>	<u>7-4</u> <u>7-3</u>	<u>6-9</u>	<u>6-4</u>	<u>6-0</u> <u>5-11</u>
	<u>2-2 x 12</u>	<u>12-2</u>	<u>10-7</u> <u>10-6</u>	<u>9-5</u>	<u>8-7</u>	<u>8-0</u> <u>7-11</u>	<u>7-6</u> <u>7-5</u>	<u>7-0</u>
	<u>3-2 x 6</u>	<u>8-2</u> <u>8-6</u>	<u>7-5</u>	<u>6-8</u>	<u>6-1</u>	<u>5-8</u> <u>5-7</u>	<u>5-3</u>	<u>5-0</u> <u>4-11</u>
	<u>3-2 x 8</u>	<u>10-10</u> <u>10-11</u>	<u>9-6</u> <u>9-5</u>	<u>8-6</u> <u>8-5</u>	<u>7-9</u> <u>7-8</u>	<u>7-2</u> <u>7-1</u>	<u>6-8</u>	<u>6-4</u> <u>6-3</u>
	<u>3-2 x 10</u>	<u>13-0</u> <u>12-11</u>	<u>11-3</u> <u>11-2</u>	<u>10-0</u>	<u>9-2</u> <u>9-1</u>	<u>8-6</u> <u>8-5</u>	<u>7-11</u>	<u>7-6</u> <u>7-5</u>
	<u>3-2 x 12</u>	<u>15-3</u>	<u>13-3</u> <u>13-2</u>	<u>11-10</u> <u>11-9</u>	<u>10-9</u>	<u>10-0</u> <u>9-11</u>	<u>9-4</u>	<u>8-10</u> <u>8-9</u>

BEAM SPECIES	BEAM SIZE	DECK JOIST SPAN						
		LESS THAN OR EQUAL TO:						
		(feet)						
		6	8	10	12	14	16	18
MAXIMUM BEAM SPAN								
(feet - inches)								
Douglas fir-larch ^{eq} hHem-fir ^{eq} Spruce-pine-fir ^{eq} redwood _. western cedars _. ponderosa pine ^f red pine ^f	3 x 6 or 2	5-5	4-8	4-2	3-10	3-6	3-1	2-9
	1-2 x 6	4-1	3-6	3-0	2-6	2-1	1-10	1-7
	3 x 8 or 2	6-10	5-11	5-4	4-10	4-6	4-1	3-8
	1-2 x 8	5-6	4-9	4-0	3-3	2-9	2-5	2-1
	3 x 10 or 2	8-4	7-3	6-6	5-11	5-6	5-1	4-8
	1-2 x 10	6-8	5-10	5-1	4-2	3-6	3-1	2-8
	3 x 12 or 2	9-8	8-5	7-6	6-10	6-4	5-11	5-7
	1-2 x 12	7-9	6-9	6-0	5-1	4-4	3-9	3-3
	4 x 6	6-5	5-6	4-11	4-6	4-2	3-11	3-8
	2-2 x 6	6-1	5-3	4-9	4-4	4-0	3-8	3-3
	4 x 8	8-5	7-3	6-6	5-11	5-6	5-2	4-10
	2-2 x 8	8-2	7-1	6-4	5-9	5-4	4-10	4-3
4 x 10	9-11	8-7	7-8	7-0	6-6	6-1	5-8	
2-2 x 10	10-0	7-9					5-5	
4 x 12	11-5	9-11	8-10	8-1	7-6	7-0	6-7	
2-2 x 12	11-7	10-0	8-11	8-2	7-7	7-1		
3-2 x 6	7-4	6-8	6-0	5-6	5-1	4-9	4-6	
	7-8	6-7	5-11	5-5	5-0	4-8	4-5	
3-2 x 8	9-8	8-6	7-7	6-11	6-5	6-0	5-8	
	10-3	8-10	7-11	7-3	6-8	6-3	5-11	
3-2 x 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11	
	12-6	10-10	9-8	8-10	8-2	7-8	7-2	
3-2 x 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1	
	14-6	12-7	11-3	10-3	9-6	8-11	8-5	
Redwood ^h	1-2 x 6	4-2	3-7	3-1	2-7	2-2	1-10	1-8
	1-2 x 8	5-4	4-7	4-1	3-4	2-10	2-6	2-2
	1-2 x 10	6-6	5-7	5-0	4-3	3-8	3-2	2-9
	1-2 x 12	7-6	6-6	5-10	5-3	4-5	3-10	3-5
	2-2 x 6	6-2	5-4	4-10	4-5	4-1	3-9	3-4
	2-2 x 8	7-10	6-10	6-1	5-7	5-2	4-10	4-4
	2-2 x 10	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	2-2 x 12	11-1	9-8	8-7	7-10	7-3	6-10	6-5

Western Cedars ^h Ponderosa Pine ^h Red Pine ^a BEAM SPECIES	BEAM SIZE	DECK JOIST SPAN							
		LESS THAN OR EQUAL TO:							
		(feet)							
		6	8	10	12	14	16	18	
		MAXIMUM BEAM SPAN							
		(feet - inches)							
	3 - 2 x 6	7-8	6-9	6-0	5-6	5-1	4-9	4-6	
	3 - 2 x 8	9-10	8-6	7-7	6-11	6-5	6-0	5-8	
	3 - 2 x 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11	
	3 - 2 x 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation permitted. Extrapolation not permitted.

b. Beams supporting a single span of joists with or without cantilever.

c. a. Ground snow load, live load = 40 psf, dead Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever with a 220-pound point load applied at the end. Snow load not assumed to be concurrent with live load.

b. Beams supporting deck joists from one side only.

d. c.No. 2 grade, wet service factor included.

e. d.Beam depth shall be equal to or greater than or equal to depth of joists with the depth intersecting joist for a flush beam condition connection.

f. g. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. e.Includes incising factor.

h. f. Northern species.Incising factor not included.

i. Deck joist span as shown in Figure R507.5

Add new text as follows:

TABLE R507.5(2)
MAXIMUM DECK BEAM SPAN - 50 PSF GROUND SNOW LOAD^c

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN (feet) ^{a,i}						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN (feet-inches) ^{a,b,f}						
Southern Pine	1-2x6	4-2	3-8	3-3	2-11	2-9	2-5	2-2
	1-2x8	5-4	4-7	4-1	3-9	3-6	3-3	2-10
	1-2x10	6-4	5-6	4-11	4-6	4-2	3-10	3-8
	1-2x12	7-6	6-5	5-9	5-3	4-10	4-7	4-3
	2-2x6	6-3	5-5	4-10	4-5	4-1	3-10	3-7
	2-2x8	7-11	6-10	6-2	5-7	5-2	4-10	4-7
	2-2x10	9-5	8-2	7-3	6-8	6-2	5-9	5-5
	2-2x12	11-1	9-7	8-7	7-10	7-3	6-9	6-5
	3-2x6	7-10	6-9	6-1	5-6	5-1	4-9	4-6
	3-2x8	9-11	8-7	7-8	7-0	6-6	6-16	5-9
	3-2x10	11-9	10-2	9-1	8-4	7-8	7-2	6-9
	3-2x12	13-11	12-0	10-9	9-10	9-1	8-6	8-0
Douglas fir-larch ^g	1-2x6	3-9	3-3	2-6	2-1	1-9	1-6	1-4
	1-2x8	5-0	4-3	3-4	2-9	2-3	2-0	1-9
	1-2x10	6-1	5-4	4-3	3-6	2-11	2-6	2-3
	1-2x12	7-1	6-2	5-2	4-3	3-7	3-1	2-9
Hem-fir ^g	2-2x6	5-7	4-10	4-4	3-11	3-6	3-0	2-8
	2-2x8	7-5	6-5	5-9	5-3	4-7	4-0	3-6
Spruce-pine-fir ^g	2-2x10	9-1	7-10	7-0	6-5	5-11	5-1	4-6
	2-2x12	10-7	9-2	8-2	7-5	6-11	6-3	5-6
	3-2x6	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	3-2x8	9-4	8-1	7-3	6-7	6-1	5-8	5-4
	3-2x10	11-5	9-10	8-10	8-1	7-5	7-0	6-7
	3-2x12	13-3	11-6	10-3	9-5	8-8	8-1	7-8
Redwood ^h	1-2x6	3-10	3-4	2-7	2-2	1-10	1-7	1-5
	1-2x8	4-10	4-2	3-5	2-10	2-4	2-1	1-10
	1-2x10	5-11	5-1	4-4	3-7	3-0	2-8	2-4
	1-2x12	6-10	5-11	5-4	4-4	3-8	3-2	2-10
Western Cedars ^h	2-2x6	5-8	4-11	4-5	4-0	3-7	3-1	2-9
	2-2x8	7-2	6-3	5-7	5-1	4-8	4-1	3-8
Ponderosa Pine ^h	2-2x10	8-9	7-7	6-9	6-2	5-9	5-3	4-8
	2-2x12	10-2	8-10	7-10	7-2	6-8	6-3	5-8
Red Pine ^h	3-2x6	7-1	6-2	5-6	5-0	4-8	4-4	4-1
	3-2x8	9-0	7-9	6-11	6-4	5-11	5-6	5-2
	3-2x10	11-0	9-6	8-6	7-9	7-2	6-9	6-4
	3-2x12	12-9	11-0	9-10	9-0	8-4	7-9	7-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(3)
MAXIMUM DECK BEAM SPAN - 60 PSF GROUND SNOW LOAD ^c

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN ^{a,h} (feet)						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN ^{a,b,f}						
Southern pine	1-2x6	3-11	3-4	3-0	2-9	2-5	2-1	1-10
	1-2x8	4-11	4-3	3-10	3-6	3-2	2-9	2-5
	1-2x10	5-10	5-1	4-6	4-2	3-10	3-6	3-1
	1-2x10	6-11	6-0	5-4	4-10	4-6	4-3	3-10
	2-2x6	5-9	5-0	4-6	4-1	3-9	3-6	3-4
	2-2x8	7-4	6-4	5-8	5-2	4-9	4-6	4-3
	2-2x10	8-8	7-6	6-9	6-2	5-8	5-4	5-0
	2-2x12	10-3	8-11	7-11	7-3	6-8	6-3	5-11
	3-2x6	7-3	6-3	5-7	5-1	4-9	4-5	4-2
	3-2x8	9-2	7-11	7-1	6-6	6-0	5-7	5-3
	3-2x10	10-11	9-5	8-5	7-8	7-2	6-8	6-3
	3-2x12	12-10	11-2	9-11	9-1	8-5	7-10	7-5
Douglas fir-larch ^a	1-2x6	3-5	2-9	2-2	1-9	1-6	1-3	1-1
	1-2x8	4-8	3-8	2-10	2-4	1-11	1-8	1-6
	1-2x10	5-8	4-8	3-8	3-0	2-6	2-2	1-11
	1-2x12	6-7	5-8	4-5	3-7	3-1	2-7	2-3
Hem-fir ^a	2-2x6	5-2	4-5	4-0	3-6	3-0	1-11	1-8
	2-2x8	6-11	5-11	5-4	4-8	3-11	3-5	3-0
Spruce-pine-fir ^a	2-2x10	8-5	7-3	6-6	5-11	5-1	4-5	3-10
	2-2x12	9-9	8-5	7-7	6-11	6-2	5-4	4-8
	3-2x6	6-5	5-7	5-0	4-7	4-3	3-11	3-5
	3-2x8	8-8	7-6	6-8	6-1	5-8	5-2	4-7
	3-2x10	10-7	9-2	8-2	7-5	6-11	6-5	5-10
3-2x12	12-3	10-8	9-6	8-8	8-0	7-6	7-1	
Redwood ^h	1-2x6	3-6	2-10	2-3	1-10	1-7	1-4	1-2
	1-2x8	4-6	3-9	2-11	2-5	2-0	1-9	1-7
Western Cedars ^h	1-2x10	5-6	4-9	3-9	3-1	2-7	2-3	2-0
	1-2x12	6-4	5-6	4-7	3-9	3-2	2-9	2-5
Ponderosa Pine ^h	2-2x6	5-3	4-6	4-1	3-8	3-1	2-8	2-4
	2-2x8	6-8	5-9	5-2	4-8	4-1	3-6	3-1
Red Pine ^h	2-2x10	8-1	7-0	6-3	5-9	5-2	4-6	4-0
	2-2x12	9-5	8-2	7-3	6-8	6-2	5-6	4-10
	3-2x6	6-7	5-8	5-1	4-8	4-4	4-0	3-7
	3-2x8	8-4	7-2	6-5	5-11	5-5	5-1	4-8
	3-2x10	10-2	8-10	7-10	7-2	6-8	6-3	5-10
3-2x12	11-9	10-2	9-1	8-4	7-8	7-3	6-10	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(4)
MAXIMUM DECK BEAM SPAN - 70 PSF GROUND SNOW LOAD ^c

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN (feet) ^{a,i}						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN ^{a,b,f} (feet-inches)						
Southern Pine	1-2x6	3-8	3-2	2-10	2-1	1-10	1-4	1-7
	1-2x8	4-7	4-0	3-7	3-3	2-9	2-5	2-2
	1-2x10	5-6	4-9	4-3	3-10	3-7	3-1	2-9
	1-2x12	6-5	5-7	5-0	4-7	4-3	3-9	3-4
	2-2x6	5-5	4-8	4-2	3-10	3-6	3-3	3-1
	2-2x8	6-10	5-11	5-4	4-10	4-6	4-2	3-11
	2-2x10	8-2	7-1	6-4	5-9	5-4	5-0	4-8
	2-2x12	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	3-2x6	6-9	5-10	5-3	4-9	4-5	4-2	3-11
	3-2x8	8-7	7-5	6-8	6-1	5-7	5-3	4-11
	3-2x10	10-2	8-10	7-11	7-2	6-8	6-3	5-10
	3-2x12	12-0	10-5	9-4	8-6	7-10	7-4	6-11
Douglas fir-larch ^g	1-2x6	3-3	2-5	1-10	1-6	1-3	1-1	1-0
	1-2x8	4-4	3-2	2-6	2-0	1-8	1-6	1-4
	1-2x10	5-4	4-1	3-2	2-7	2-2	1-11	1-8
	1-2x12	6-2	5-0	3-10	3-2	2-8	2-4	2-0
Hem-fir ^g	2-2x6	4-10	4-2	3-9	3-1	2-7	2-3	2-0
	2-2x8	6-5	5-7	5-0	4-1	3-5	3-0	2-8
Spruce -pine-fir ^g	2-2x10	7-10	6-10	6-1	5-39	4-5	3-10	3-5
	2-2x12	9-2	7-11	7-1	6-4	5-5	4-8	4-1
	3-2x6	6-0	5-31	4-8	4-3	3-11	3-5	3-0
	3-2x8	8-1	7-0	6-3	5-8	5-2	4-6	4-0
	3-2x10	9-10	8-6	7-8	7-0	6-5	5-9	5-1
	3-2x12	11-6	9-11	8-11	8-1	7-6	7-0	6-3
Redwood ^h	1-2x6	3-4	2-6	1-11	1-7	1-4	1-2	1-0
	1-2x8	4-2	3-3	2-7	2-1	1-9	1-7	1-4
	1-2x10	5-1	4-2	3-3	2-8	2-3	2-0	1-9
	1-2x12	5-11	5-1	4-0	3-3	2-9	2-5	2-1
	2-2x6	4-11	4-3	3-10	3-2	2-8	2-4	2-1
Western Cedars ^h	2-2x8	6-3	5-5	4-10	4-2	3-7	3-1	2-9
Ponderosa Pine ^h	2-2x10	7-7	6-7	5-10	5-4	4-7	3-11	3-6
	2-2x12	8-10	7-7	6-10	6-3	5-6	4-10	4-3
Red Pine ^h	3-2x6	6-2	5-4	4-9	4-4	4-0	3-6	3-1
	3-2x8	7-9	6-9	6-0	5-6	5-1	4-8	4-1
	3-2x10	9-6	8-3	7-4	6-9	6-3	5-10	5-3
	3-2x12	11-0	9-6	8-6	7-9	7-3	6-9	6-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

Revise as follows:

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7. ~~The maximum joist cantilever shall be limited to one-fourth of the joist span or the maximum cantilever length specified in Table R507.6, whichever is less.~~

Delete and substitute as follows:

**TABLE R507-6
DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft. – in.)**

SPECIES ^a	SIZE	ALLOWABLE JOIST SPAN ^b			MAXIMUM CANTILEVER ^{e,f}		
		SPACING OF DECK JOISTS (inches)			SPACING OF DECK JOISTS WITH CANTILEVERS ^e (inches)		
		12	16	24	12	16	24
Southern pine	2 x 6	9-11	9-0	7-7	1-3	1-4	1-6
	2 x 8	13-1	11-10	9-8	2-1	2-3	2-5
	2 x 10	16-2	14-0	11-5	3-4	3-6	2-10
	2 x 12	18-0	16-6	13-6	4-6	4-2	3-4
Douglas fir-larch ^d , hem-fir ^d , spruce-pine-fir ^d ,	2 x 6	9-6	8-8	7-2	1-2	1-3	1-5
	2 x 8	12-6	11-1	9-1	1-11	2-1	2-3
	2 x 10	15-8	13-7	11-1	3-1	3-5	2-9
	2 x 12	18-0	15-9	12-10	4-6	3-11	3-3
Redwood, western cedars, ponderosa pine ^e , red pine ^e	2 x 6	8-10	8-0	7-0	1-0	1-1	1-2
	2 x 8	11-8	10-7	8-8	1-8	1-10	2-0
	2 x 10	14-11	13-0	10-7	2-8	2-10	2-8
	2 x 12	17-5	15-1	12-4	3-10	3-9	3-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a.No. 2 grade with wet service factor.

b.Ground snow load, live load = 40 psf, dead load = 10 psf, L/A = 360.

c.Ground snow load, live load = 40 psf, dead load = 10 psf, L/A = 360 at main span, L/A = 180 at cantilever with a 220 pound point load applied to end.

d.Includes incising factor.

e.Northern species with no incising factor.

f.Cantilevered spans not exceeding the nominal depth of the joist are permitted.

**TABLE R507.6
MAXIMUM DECK JOIST SPANS**

LOAD ^a (psf)	JOIST SPECIES ^b	JOIST SIZE	JOIST SPACING			ADJACENT JOIST SPAN ^d								
			(inches)			(feet)								
			12	16	24	4	6	8	10	12	14	16	18	
			MAXIMUM JOIST SPAN ^c			MAXIMUM CANTILEVER ^d								
(feet-inches)			(feet-inches)											
40 Live Load	Southern Pine	2x6	9-11	9-0	7-7	1-0	1-6	1-5	NP	NP	NP	NP	NP	
		2x8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	2-3	NP	NP	NP	
		2x10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-4	3-4	NP	
		2x12	18-0	16-6	13-6	1-0	1-6	2-0	-6	3-0	3-6	4-0	4-1	
	Douglas fir-larch ^e	2x6	9-6	8-4	6-10	1-0	1-6	1-4	NP	NP	NP	NP	NP	
	Hem-fir ^e	2x8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	2-0	NP	NP	NP	
		2x10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP	
	Spruce-pine-fir ^e	2x12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	3-0	3-6	3-11	3-11	
	Redwood ^f	2x6	8-10	8-0	6-10	1-0	1-4	1-1	NP	NP	NP	NP	NP	
	Western Cedars ^f	2x8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	NP	NP	NP	NP	
		2x10	14-11	13-0	10-7	1-0	1-6	2-0	2-6	3-0	2-9	NP	NP	
	Ponderosa Pine ^f	2x12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP	
	Red Pine ^f	2x12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP	
	50 Ground Snow Load	Southern Pine	2x6	9-2	8-4	7-4	1-0	1-6	1-5	NP	NP	NP	NP	NP
			2x8	12-1	11-0	9-7	1-0	1-6	2-0	2-5	2-3	NP	NP	NP
			2x10	15-5	14-1	12-3	1-0	1-6	2-0	2-6	3-0	3-1	NP	NP
2x12			18-0	17-1	14-6	1-0	1-6	2-0	2-6	3-0	3-6	3-10	3-10	
Douglas fir-larch ^e		2x6	8-10	8-0	7-0	1-0	1-6	1-4	NP	NP	NP	NP	NP	
Hem-fir ^e		2x8	11-7	10-7	9-3	1-0	1-6	2-0	2-3	NP	NP	NP	NP	
		2x10	14-10	13-6	11-9	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP	
Spruce-pine-fir ^e		2x12	18-0	16-5	13-9	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP	
Redwood ^f		2x6	8-3	7-6	6-8	1-0	1-4	1-1	NP	NP	NP	NP	NP	
Western Cedars ^f		2x8	10-10	9-10	8-7	1-0	1-6	2-0	1-11	NP	NP	NP	NP	
		2x10	13-10	12-7	11-0	1-0	1-6	2-0	2-6	2-9	NP	NP	NP	
Ponderosa Pine ^f		2x12	16-10	15-3	13-2	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP	
Red Pine ^f		2x12	16-10	15-3	13-2	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP	
60 Ground		Southern Pine	2x6	8-8	7-10	6-10	1-0	1-6	1-5	NP	NP	NP	NP	NP
			2x8	11-5	10-4	9-1	1-0	1-6	2-0	2-4	NP	NP	NP	NP
			2x10	14-7	13-3	11-7	1-0	1-6	2-0	2-6	2-11	2-11	NP	NP
	2x12		17-8	16-1	14-0	1-0	1-6	2-0	2-6	3-0	3-6	3-7	NP	
	Douglas fir-larch ^e	2x6	8-4	7-6	6-7	1-0	1-6	1-4	NP	NP	NP	NP	NP	
		2x8	10-11	9-11	8-8	1-0	1-6	2-0	2-2	NP	NP	NP	NP	
		2x10	13-11	12-8	11-1	1-0	1-6	2-0	2-6	2-10	NP	NP	NP	
		2x12	17-0	15-5	13-6	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP	
	Hem-fir ^e	2x6	8-4	7-6	6-7	1-0	1-6	1-4	NP	NP	NP	NP	NP	
		2x8	10-11	9-11	8-8	1-0	1-6	2-0	2-2	NP	NP	NP	NP	
		2x10	13-11	12-8	11-1	1-0	1-6	2-0	2-6	2-10	NP	NP	NP	
		2x12	17-0	15-5	13-6	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP	

Snow Load LOAD (psf)	Spruce-pine-fir ^e JOIST SPECIES	JOIST SIZE	JOIST SPACING			ADJACENT JOIST SPAN							
			(inches)			(feet)							
			12	16	24	4	6	8	10	12	14	16	18
			MAXIMUM JOIST SPAN			MAXIMUM CANTILEVER							
(feet-inches)			(feet-inches)										
	Redwood f.	2x6	7-9	7-0	6-2	1-0	1-4	NP	NP	NP	NP	NP	NP
	Western Cedars f.	2x8	10-2	9-3	8-1	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	13-0	11-10	10-4	1-0	1-6	2-0	2-6	2-7	NP	NP	NP
	Ponderosa Pine f.												
	Red Pine f.	2x12	15-10	14-4	12-7	1-0	1-6	2-0	2-6	3-0	3-2	NP	NP
70 Ground Snow Load	Southern Pine	2x6	8-3	7-6	6-6	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	10-10	9-10	8-7	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2x10	13-10	12-7	11-0	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2x12	16-10	15-3	13-4	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Douglas fir-larch ^e	2x6	7-11	7-2	6-3	1-0	1-6	NP	NP	NP	NP	NP	NP
	Hem-fir ^e	2x8	10-5	9-5	8-3	1-0	1-6	2-0	2-1	NP	NP	NP	NP
		2x10	13-3	12-0	10-6	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
	Spruce-pine-fir ^e	2x12	16-1	14-8	12-10	1-0	1-6	2-0	2-6	3-0	3-3	3-3	NP
Redwood f.	2x6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP	
	Western Cedars f.	2x8	9-8	8-10	7-8	1-0	1-6	1-11	NP	NP	NP	NP	
		2x10	12-4	11-3	9-10	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
	Ponderosa Pine f.												
Red Pine f.	2x12	15-0	13-8	11-11	1-0	1-6	2-0	2-6	2-0	3-0	NP	NP	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg, NP = Not Permitted

a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.

b. No. 2 grade, wet service factor included.

c. L/Δ = 360 at main span.

d. L/Δ = 180 at cantilever with 220-pound point load applied to end.

e. Includes incising factor.

f. Incising factor not included.

g. Interpolation permitted. Extrapolation is not permitted.

TABLE R507.9.1.3(1)

DECK LEDGER CONNECTION TO BAND JOIST^{a, b} (Deck live load = 40 psf, deck dead load = 10 psf, snow load ≤ 40 psf)

CONNECTION DETAILS	JOIST SPAN						
	6' and less	6'1" to 8'	8'1" to 10'	10'1" to 12'	12'1" to 14'	14'1" to 16'	16'1" to 18'
	On-center spacing of fasteners						
¹ / ₂ inch diameter lag screw with ¹ / ₂ inch maximum sheathing ^{c, e}	30	23	18	15	13	11	10
¹ / ₂ inch diameter bolt with ¹ / ₂ inch maximum sheathing ^d	36	36	34	29	24	21	19
¹ / ₂ inch diameter bolt with 1 inch maximum sheathing ^e	36	36	29	24	21	18	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
- b. Snow load shall not be assumed to act concurrently with live load.
- c. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
- d. Sheathing shall be wood structural panel or solid sawn lumber.
- e. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to ¹/₂ inch thickness of stacked washers shall be permitted to substitute for up to ¹/₂ inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST

LOAD ^c (psf)	JOIST SPAN ^a (feet)	<u>1/2-inch diameter</u> lag screw with <u>1/2-inch maximum</u> sheathing ^{d,e}	<u>1/2-inch diameter</u> bolt with <u>1/2-inch maximum</u> sheathing ^e	<u>1/2-inch diameter</u> bolt with <u>1-inch maximum</u> sheathing ^f
		<u>On-CENTER SPACING OF FASTENERS ^b</u> (inches)		
		40 Live Load	6	30
8	23		36	36
10	18		34	29
12	15		29	24
14	13		24	21
16	11		21	18
18	10		19	16
50 Ground Snow Load	6	29	36	36
	8	22	36	35
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
60 Ground Snow Load	6	25	36	36
	8	18	35	30
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
70 Ground Snow Load	6	22	36	35
	8	16	31	26
	10	13	25	21
	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted. Extrapolation is not permitted.

b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.

c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.

d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.

e. Sheathing shall be wood structural panel or solid sawn lumber.

f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

Reason: From roughly scanning Figure R301.2(6) Ground Snow Loads, it appears that as much as ten percent of the country lives in areas where the ground snow load exceeds the live load in Table R301.5. The Deck Code Coalition proposes to prescriptively offer the people in these areas with revised tables.

The IRC's prescriptive deck provisions currently only include a 40 psf live load and 10 psf dead load. This proposal is to widen the deck provisions to include up to 70 psf ground snow load to more closely match the scope of the IRC.

For snow loading, an increase in wood strength is accounted for the load duration per the NDS®. While the geometry of the deck and nearby structures can affect the snow loading by causing drifts or snow falling from a nearby roof, these effects are neglected just as in other IRC tables, such as roof rafters. Similarly, elevated decks would have a snow load less than the ground snow load, but this reduction is neglected for simpler tables that are easy to use.

· Table R507.3.1 Minimum Footing Size for Decks - currently the table includes footings from 40 to 70 psf, but limits the minimum size of footing to 12" x 12", which is significantly oversized for small areas such as a stair landing. New rows have been added for a smaller 7"x7" footing which is more appropriate and allows for some precast concrete solutions.

· Table R507.4 Maximum Deck Post Height –the table is based now on tributary area 40,50,60, and 70 psf loading.

· Table R507.5(1) Maximum Deck Beam Span was replaced with four new tables R507.5(1) – (4) to account for the 40, 50, 60, and 70 psf loading. Section R507.5.2 now includes information that was previously in a footnote. The load from tributary areas are altered to reflect joists and beams with cantilevers.

· Table R507.6 Maximum Deck Joist Spans was amended to account for the 40, 50, 60, and 70 psf loading. The formatting of the table is significantly altered to clarify common confusion on allowable cantilevers. Previously, the table gave the allowable cantilever in terms of joist spacing. Since the assumed main span was the allowable span for that spacing, the maximum cantilevers sometimes became smaller as joist spacing became tighter. The new format has the cantilevers be more accurately based upon the main span. The previous table included a cantilever limit of 1/4 the main span, and this limit is preserved. Where cantilevers are not permitted, the size of lumber is too small to support that main span.

· Table R507.9.1.3(1) Deck Ledger Connection to Band Joist - the table is based now on tributary area 40,50,60, and 70 psf loading, but uses the same empirical capacities from the original table.

Cost Impact: The code change proposal will increase the cost of construction

In those parts of the country where the ground snow load exceeds 40 psf, it could be assumed that there would be an increased cost of construction if the local jurisdictions allowed decks to be built with a lesser live load than the ground snow load might warrant for their areas. However, by adding 50,60, and 70 psf to the prescriptive tables, some builders may save money by eliminating the cost of engineering that might otherwise be required.

For the other ninety percent of the country, there would not be an anticipated increased cost of construction, in fact there could be a reduced cost for some situations where a smaller footing requirement may be applicable.

RB184-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There were multiple corrections expressed in a modification that the committee felt were too extensive. The wording in Section 507.4 is confusing. The committee urges that the corrections should be brought forward in a public comment. The collaborative effort, and inclusion of engineers in the effort, was a positive aspect for this proposal. (Vote: 10-1)

Assembly Action:

None

RB184-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R507.3.1

Proponents:

Charles Bajnai, Retired from Chesterfield County, VA, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glenmathewson.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

**TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS**

LIVE OR GROUND SNOW LOAD ^b (psf)	TRIBUTARY AREA (sq. ft.)	LOAD-BEARING VALUE OF SOILS SOIL BEARING CAPACITY ^{a, c, d} (psf)										
		1500 ^e			2000 ^e			2500 ^e			3000 ^e	
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness ^f (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness ^f (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)
40	5	7	8	6	7	8	6				7	8
	20	12 10	14 12	6	12 9	14 10	6	12	14	6	12 7	14 8
	40	14	16	6	12	14	6	12	14	6	12 10	14 12
	60	17	19	6	15	17	6	13	15	6	12	14
	80	20	22	7	17	19	6	15	17	6	14	16
	100	22	25	8	19	21	6	17	19	6	15	17
	120	24	27	9	21	23	7	19	21	6	17	19
	140	26	29	10	22	25	8	20	23	7	18	21
50	5	7	8	6	7	8	6				7	8
	20	12 11	14 13	6	12 10	14 11	6	12	14	6	12 8	14 9
	40	15	17	6	13	15	6	12	14	6	12 11	14 13
	60	19	21	6	16	18	6	14	16	6	13	15
	80	21	24	8	19	21	6	17	19	6	15	17
	100	24	27	9	21	23	7	19	21	6	17	19
	120	26	30	10	23	26	8	20	23	7	19	21
	140	28	32	11	25	28	9	22	25	8	20	23
60	5	7	8	6	7	8	6				7	8
	20	12	14	6	12 11	14 12	6	12	14	6	12 9	14 10
	40	16	19	6	14	16	6	13	14	6	12	14
	60	20	23	7	17	20	6	16	18	6	14	16
	80	23	26	9	20	23	7	18	20	6	16	19
	100	26	29	10	22	25	8	20	23	7	18	21
	120	28	32	11	25	28	9	22	25	8	20	23
	140	31	35	12	27	30	10	24	27	9	22	24
70	5	7	8	6	7	8	6				7	8
	20	12	14	6	12 11	14 13	6	12	14	6	12 9	14 10
	40	18	20	6	15	17	6	14	15	6	12	14
	60	21	24	8	19	21	6	17	19	6	15	17
	80	25	28	9	21	24	8	19	22	7	18	20
	100	28	31	11	24	27	9	21	24	8	20	22
	120	30	34	12	26	30	10	24	27	9	21	24
	140	33	37	13	28	32	11	25	29	10	23	26
160	35	40	15	30	34	12	27	31	11	25	28	

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

- a. Interpolation permitted, extrapolation not permitted.
- b. Based on highest load case: Dead + Live or Dead + Snow.
- c. ~~Assumes minimum square footing to be 12 inches x 12 inches x 6 inches for 6 x 6 post.~~ Footing dimensions shall allow complete bearing of the post.
- d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.
- e. Area, in square feet, of deck surface supported by post and footings.
- f. Minimum thickness shall only apply to plain concrete footings.

Commenter's Reason: The Deck Code Coalition submits this public comment to amend and increase the functionality of Table R507.3.1.

- 1. It makes small editorial changes and corrections to the table.
- 2. It increases footings table to include tributary areas of 5 square feet, which is common for stair landings and also provides a lower bound for interpolation in the table.
- 3. Removes three columns for 2500 psf soil bearing capacity, because these values can be easily determined by interpolation.
- 4. Changes the minimum allowed footing from 12"x 12" or 14" in diameter to a more reasonable 7" x 7" or 8" in diameter.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This will allow for smaller footings where appropriate.

Staff Analysis: There are four public comments to RB184, three which are for replacements of parts of the proposal, and one asking for the proposal as modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1132

Public Comment 2:

IRC@: R507.4, TABLE R507.4

Proponents:

Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glenmathewson.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R507.4 Deck posts. For single-level ~~wood-framed decks with beams sized in accordance with Table R507.5,~~ wood deck post size shall be in accordance with Table R507.4.

**TABLE R507.4
MAXIMUM DECK POST HEIGHT^a**

DECK POST SIZE	MAXIMUM HEIGHT ^{a-b} (feet-inches)
4x4	6-9 ^e
4x6	8
6x6	14
8x8	14

POST SPECIES ^c	NOMINAL POST SIZE ^d	MAXIMUM DECK POST HEIGHT ^{a,b}								
		(feet-inches)								
		Tributary Area								
		(sqft)								
		20	40	60	80	100	120	140	160	
Southern Pine	4x4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2	
	4x6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2	
	6x6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Douglas Fir ^{e,1}	4x4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3	
	4x6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10	
Hem- Fir ^{e,1}	6x6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
SPF ^e	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Redwood ^{f,1}	4x4	14-0	13-2	10-3	8-1	5-8	NP	NP	NP	
	4x6	14-0	14-0	13-6	11-4	9-9	8-4	6-9	4-7	
Western Cedars ^{f,1}	6x6	14-0	14-0	14-0	14-0	14-0	14-0	13-7	9-7	
Ponderosa Pine ^{f,1}	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Red Pine ^f	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa. NP=Not permitted

- a. Measured to the underside of the beam from top of footing or pier.
- b. Based on 40 psf live load.
- c. The maximum permitted height is 8 feet for one-ply and two-ply beams. The maximum permitted height for three-ply beams on post cap is 6 feet 9 inches. No. 2 grade, wet service factor included.
- d. Notched posts shall be sized to accommodate beam size in accordance with Section R507.5.2
- e. Includes incising factor.
- f. Incising factor not included.

Commenter's Reason: The Deck Code Coalition submits this public comment to increase the functionality of Table R507.4 by expanding it based on wood species and tributary area.

It does not take into consideration snow loading that the original proposal RB184-19 was intended to do.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This public comment gives the values for post heights calculated per the NDS, so while there are a few instances where allowable post height is decreased, these values are more accurate than the current table.

Staff Analysis: There are four public comments to RB184, three which as for replacements of parts of the proposal, and on asking for as modified

by the public comment. If all four are approved, there would be a conflict.

Public Comment 3:

IRC®: R507.6, TABLE R507.6

Proponents:

Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glenmathewson.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7. ~~The maximum joist cantilever shall be limited to one-fourth of the joist span or the maximum cantilever length specified in Table R507.6, whichever is less.~~

TABLE R507.6
MAXIMUM DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft.--in.)

SPECIES ^a	SIZE	ALLOWABLE JOIST SPAN ^{b,c} (feet-inches)			MAXIMUM CANTILEVER ^{e,f,g} (feet-inches)									
		Spacing of Deck Joist Spacing (inches)			SPACING OF DECK JOISTS WITH CANTILEVERS ^e (inches) Joist Back Span ^f (feet)									
		12	16	24	4	6	8	10	12	14	16	18	24	
Southern pine	2 x 6	9-11	9-0	7-7	<u>1-0</u>	<u>1-6</u>	<u>1-5</u>	NP	<u>1-3</u> NP	NP	<u>1-4</u> NP	NP	<u>1-6</u>	
	2 x 8	13-1	11-10	9-8	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>2-1</u> <u>2-3</u>	NP	<u>2-3</u> NP	NP	<u>2-5</u>	
	2 x 10	16-2	14-0	11-5	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>3-4</u> <u>3-0</u>	<u>3-4</u>	<u>3-6</u> <u>3-4</u>	NP	<u>2-10</u>	
	2 x 12	18-0	16-6	13-6	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>4-6</u> <u>3-0</u>	<u>3-6</u>	<u>4-2</u> <u>4-0</u>	<u>4-1</u>	<u>3-4</u>	
Douglas fir-larch ^d , hem-fir ^d , spruce-pine-fir ^d	2 x 6	9-6	8-8 8-4	7-2 6-10	<u>1-0</u>	<u>1-6</u>	<u>1-4</u>	NP	<u>1-2</u> NP	NP	<u>1-3</u> NP	NP	<u>1-5</u>	
	2 x 8	12-6	11-1	9-1	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-3</u>	<u>1-11</u> <u>2-0</u>	NP	<u>2-1</u> NP	NP	<u>2-3</u>	
	2 x 10	15-8	13-7	11-1	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>3-1</u> <u>3-0</u>	<u>3-3</u>	<u>3-5</u> NP	NP	<u>2-9</u>	
	2 x 12	18-0	15-9	12-10	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>4-6</u> <u>3-0</u>	<u>3-6</u>	<u>3-11</u>	<u>3-11</u>	<u>3-3</u>	
Redwood, western cedars, ponderosa pine ^e , red pine ^e	2 x 6	8-10	8-0	7-0 6-10	<u>1-0</u>	<u>1-4</u>	<u>1-1</u>	NP	<u>1-0</u> NP	NP	<u>1-1</u> NP	NP	<u>1-2</u>	
	2 x 8	11-8	10-7	8-8	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>1-11</u>	<u>1-8</u> NP	NP	<u>1-10</u> NP	NP	<u>2-0</u>	
	2 x 10	14-11	13-0	10-7	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>2-8</u> <u>3-0</u>	<u>2-9</u>	<u>2-10</u> NP	NP	<u>2-8</u>	
	2 x 12	17-5	15-1	12-4	<u>1-0</u>	<u>1-6</u>	<u>2-0</u>	<u>2-6</u>	<u>3-10</u> <u>3-0</u>	<u>3-6</u>	<u>3-9</u> <u>3-8</u>	NP	<u>3-1</u>	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg. NP = Not permitted

- a. No. 2 grade with wet service factor.
- b. Ground snow load, live load = 40 psf, dead load = 10 psf, $L/\Delta = 360$.
- c. Ground snow load, live load = 40 psf, dead load = 10 psf, $L/\Delta = 360$ at main span; ~~$L/\Delta = 180$ at cantilever with a 220-pound point load applied to end.~~
- d. Includes incising factor.
- e. Northern species with no incising factor.
- f. ~~Cantilevered spans not exceeding the nominal depth of the joist are permitted.~~ Interpolation permitted. Extrapolation is not permitted.
- g. $L/\Delta = 180$ at cantilever with 220-pound point load applied to end.

Commenter's Reason: The Deck Code Coalition submits this public comment to correct a few errors and make Table R507.6 easier to understand. It does not take into consideration snow loading that the original RB184-19 was intended to do.

The table is changed from the 2018 IRC by adding adjacent joist spans (i.e. back spans) the allowable cantilever based upon the joist spacing and calculated with the assumption that the adjacent span is the full length allowed. Since the allowable cantilever is more dependent upon the adjacent joist back span than on the joist spacing, the table should be easier to use.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This new format will allow for longer and more accurate cantilever lengths.

Staff Analysis: There are four public comments to RB184, three which are for replacements of parts of the proposal, and one asking for it as modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1163

Public Comment 4:

IRC®: TABLE R507.3.1, R507.4, TABLE R507.4, TABLE R507.5(1), TABLE R507.5(2) (New), TABLE R507.5(3) (New), TABLE R507.5(4) (New), TABLE R507.6, TABLE R507.9.1.3(1)

Proponents:

Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glenmathewson.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS**

LIVE OR GROUND SNOW LOAD ^b (psf)	TRIBUTARY AREA ^e (sq. ft.)	SOIL BEARING CAPACITY ^{a, c, d}								
		1500 psf			2000 psf			≥ 3000 psf		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness _f (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness _f (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness _f (inches)
40	5	7	8	6	7	8	6	<u>7</u>	<u>8</u>	<u>6</u>
	20	10	10 <u>12</u>	6	9	9	6	7	8	6
	40	14	14 <u>16</u>	7 <u>6</u>	12	13 <u>14</u>	6	10	10 <u>12</u>	6
	60	17	18 <u>19</u>	9 <u>6</u>	15	15 <u>17</u>	8 <u>6</u>	12	13 <u>14</u>	6
	80	20	22	7	17	19	6	14	16	6
	100	22	25	8	19	21	6	15	17	6
	120	24	27	9	21	23	7	17	19	6
	140	26	29	10	22	25	8	18	21	6
	160	28	31	11	24	27	9	20	22	7
50	5	7	8	6	7	8	6	<u>7</u>	<u>8</u>	<u>6</u>
	20	11	12 <u>13</u>	6	10	10 <u>11</u>	6	8	8 <u>9</u>	6
	40	16 <u>15</u>	16 <u>17</u>	6	8 <u>13</u>	14 <u>15</u>	6	11	12 <u>13</u>	6
	60	19	21	6	16	18	6	13	15	6
	80	21	24	8	19	21	6	15	17	6
	100	24	27	9	21	23	7	17	19	6
	120	26	30	10	23	26	8	19	21	6
	140	28	32	11	25	28	9	20	23	7
	160	30	34	12	26	30	10	21	24	8
60	5	7	8	6	7	8	6	<u>7</u>	<u>8</u>	<u>6</u>
	20	12	13 <u>14</u>	6	11	11 <u>12</u>	6	9	9 <u>10</u>	6
	40	17 <u>16</u>	18 <u>19</u>	6	15 <u>14</u>	15 <u>16</u>	8	12	13 <u>14</u>	6
	60	20	23	7	17	20	6	14	16	6
	80	23	26	9	20	23	7	16	19	6
	100	26	29	10	22	25	8	18	21	6
	120	28	32	11	25	28	9	20	23	7
	140	31	35	12	27	30	10	22	24	8
	160	33	37	13	28	32	11	23	26	9
70	5	7	8	6	7	8	6	7	8	6
	20	13 <u>12</u>	14	7 <u>6</u>	11	12 <u>13</u>	6	9	10	6
	40	18	19 <u>20</u>	9 <u>6</u>	16 <u>15</u>	17	8 <u>6</u>	13 <u>12</u>	14	7 <u>6</u>
	60	21	24	8	19	21	6	15	17	6
	80	25	28	9	21	24	8	18	20	6
	100	28	31	11	24	27	9	20	22	7
	120	30	34	12	26	30	10	21	24	8
	140	33	37	13	28	32	11	23	26	9
	160	35	40	15	30	34	12	25	28	9

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

- a. Interpolation permitted, extrapolation not permitted.
- b. Based on highest load case: Dead + Live or Dead + Snow.
- c. Footing dimensions shall allow complete bearing of the post.
- d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.
- e. Area, in square feet, of deck surface supported by post and footings.
- f. Minimum thickness shall only apply to plain concrete footings.

R507.4 Deck posts. For single-level decks, wood deck-post size shall be in accordance with Table R507.4.

**TABLE R507.4
DECK POST HEIGHT**

Portions of table not shown remain unchanged.

LOADS ^b (psf)	POST SPECIES ^c	POST SIZE ^d	TRIBUTARY AREA ^{g,h} (sqft)												
			MAXIMUM DECK POST HEIGHT ^a												
			(feet-inches)												
			Tributary Area ^{g,h}												
(sqft)								20	40	60	80	100	120	140	160
40 Live Load	Southern Pine	4 x 4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2					
		4 x 6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2					
		6 x 6	14-0	14-0	11-0 14-0	14-0	14-0	14-0	14-0	14-0	14-0				
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0				
	Douglas Fir ^e ,	4 x 4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3					
		4 x 6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10					
	Hem-fir ^e ,	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
	SPF ^e	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
	Redwood ^f ,	4 x 4	14-0	12-1 13-2	9-8 10-3	8-22 8-1	7-1 5-8	6-2 NP	5-3 NP	4-2 NP					
		4 x 6	14-0	14-0	12-4 13-6	10-7 11-4	9-4 9-9	8-4	7-7 6-9	6-11 4-7					
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0 13-7	12-10 9-7					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
Western Cedars ^f ,	4 x 4	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						
	4 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						
Ponderosa Pine ^f ,	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						
Red Pine ^f	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						
50 Ground Snow Load	Southern Pine	4 x 4	14-0	12-2	9-10	8-5	7-5	9-7 6-7	5-11	5-4					
		4 x 6	14-0	14-0	12-6	10-9	9-6	8-7	7-10	7-3					
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	13-4					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
	Douglas Fir ^e ,	4 x 4	14-0	12-1	9-8	8-2	7-1	6-2	5-3	4-2					
		4 x 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11					
	Hem-fir ^e ,	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
	SPF ^e	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
	Redwood ^f ,	4 x 4	14-0	11-8	9-0	6-10	3-7	NP	NP	NP					
		4 x 6	14-0	14-0	12-0	10-0	8-6	7-0	5-3	NP					
	Western Cedars ^f ,	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4					
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0					
Ponderosa Pine ^f ,	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						
Red Pine ^f	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						
Southern Pine	4 x 4	14-0	11-1	8-11	7-7	6-7	5-10	5-2	4-6						
	4 x 6	14-0	14-0	11-4	9-9	8-7	7-9	7-1	6-6						
	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-9	11-2						
	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0						

60	Ground	Douglas Fir ^e ,	4 x 4	14-0	10-11	8-8	7-3	6-2	5-0	3-7	NP
		Hem-fir ^e ,	4 x 6	14-0	13-11	11-2 11-2	9-7	8-4	7-5	6-8	5-11
	Snow	SPF ^e	6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-2	10-2
			8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Load	Redwood ^f ,	4 x 4	14-0	10-6	7-9	4-7	NP	NP	NP	NP
		Western Cedars ^f ,	4 x 6	14-0	13-7	10-9	8-9	7-0	4-9	NP	NP
			6 x 6	14-0	14-0	14-0	14-0	14-0	9-9	NP	NP
		Ponderosa Pine ^f ,									
		Red Pine ^f	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	70	Ground	Southern Pine	4 x 4	14-0	10-2	8-2	6-11	5-11	5-2	4-4
4 x 6				14-0	12-11	10-5	8-11	7-10	7-1	6-5	5-10
6 x 6				14-0	14-0	14-0	14-0	14-0	12-9	10-11	8-7
8 x 8				14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
Snow		Douglas Fir ^e ,	4 x 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP
			4 x 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11
			6 x 6	14-0	14-0	14-0	14-0	14-0	12-2	9-9	5-9
Load		SPF ^e	8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
			Redwood ^f ,	4 x 4	14-0	9-5	6-5	NP	NP	NP	NP
		Western Cedars ^f ,	4 x 6	14-0	12-6	9-8	7-7	5-3	NP	NP	NP
			6 x 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP
		Ponderosa Pine ^f ,									
Red Pine ^f		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa., NP = Not Permitted

- a. Measured from the underside of the beam to top of footing or pier.
- b. 10 psf dead load. Snow load not assumed to be concurrent with live load.
- c. No. 2 grade, wet service factor included.
- d. Notched deck posts shall be sized to accommodate beam size per in accordance with Section R507.5.2
- e. Includes incising factor.
- f. Incising factor not included.
- g. Area, in square feet, of deck surface supported by post and footings.
- h. Interpolation permitted. Extrapolation not permitted.

**ABLE R507.5(1)
MAXIMUM DECK BEAM SPAN - 40 PSF LIVE LOAD ^c**

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN ^{a+} (feet)							
		MAXIMUM BEAM SPAN ^{a,b,f} (feet-inches)							
		Deck Joist Span ^{a,i} (feet)							
		6	8	10	12	14	16	18	
Southern Pine	1-2 x 6	4-7	4-0	3-7	3-3	3-0	2-10	2-7 <u>2-8</u>	
	1-2 x 8	5-10 <u>5-11</u>	5-1	4-6 <u>4-7</u>	4-1 <u>4-2</u>	3-10	3-7	3-4 <u>3-5</u>	
	1-2 x 10	6-11 <u>7-0</u>	6-0	5-4 <u>5-5</u>	4-11	4-6 <u>4-7</u>	4-3	4-0	
	1-2 x 12	8-2 <u>8-3</u>	7-1	6-4	5-9 <u>5-10</u>	5-4 <u>5-5</u>	5-0	4-8 <u>4-9</u>	
	2-2 x 6	6-10 <u>6-11</u>	5-11	5-3 <u>5-4</u>	4-10	4-6	4-2 <u>4-3</u>	3-11 <u>4-0</u>	
	2-2 x 8	8-8 <u>8-9</u>	7-6 <u>7-7</u>	6-9	6-2	5-8 <u>5-9</u>	5-4	5-0	
	2-2 x 10	10-4	8-11 <u>9-0</u>	8-0	7-3 <u>7-4</u>	6-9	6-4	5-11 <u>6-0</u>	
	2-2 x 12	12-2	10-6 <u>10-7</u>	9-5	8-7	7-11 <u>8-0</u>	7-5	7-0	
	3-2 x 6	8-6	7-5	6-8	6-1	5-7 <u>5-8</u>	5-3	4-11	
	3-2 x 8	10-11	9-5 <u>9-6</u>	8-5 <u>8-6</u>	7-8 <u>7-9</u>	7-1 <u>7-2</u>	6-8	6-3 <u>6-4</u>	
	3-2 x 10	12-11 <u>13-0</u>	11-2	10-0	9-1 <u>9-2</u>	8-5 <u>8-6</u>	7-11	7-5 <u>7-6</u>	
3-2 x 12	15-3	13-2 <u>13-3</u>	11-9 <u>11-10</u>	10-9	9-11 <u>10-0</u>	9-4	8-9 <u>8-10</u>		
Douglas fir-larch ^g , Hem-fir ^g , Spruce-pine-fir ^g	1-2 x 6	4-1	3-6	3-0	2-6 <u>2-8</u>	2-1 <u>2-5</u>	1-10 <u>2-3</u>	1-7 <u>2-1</u>	
	1-2 x 8	5-6	4-9 <u>4-8</u>	4-0	3-3 <u>3-6</u>	2-9 <u>3-2</u>	2-5 <u>2-11</u>	2-1 <u>2-9</u>	
	1-2 x 10	6-8	5-10	5-1	4-2 <u>4-6</u>	3-6 <u>4-1</u>	3-1 <u>3-9</u>	2-8 <u>3-6</u>	
	1-2 x 12	7-9	6-9	6-0	5-1 <u>5-6</u>	4-4 <u>5-0</u>	3-9	3-3 <u>3-6</u>	
	2-2 x 6	6-1	5-3	4-9	4-4	4-0 <u>3-11</u>	3-8 <u>3-7</u>	3-3	
	2-2 x 8	8-2	7-1	6-4	5-9	5-4 <u>5-2</u>	4-10 <u>4-8</u>	4-3 <u>4-4</u>	
	2-2 x 10	10-0	8-7	7-9	7-0	6-6	6-1 <u>6-0</u>	5-5 <u>5-6</u>	
	2-2 x 12	11-7	10-0	8-11	8-2	7-7	7-1	6-7 <u>6-8</u>	
	3-2 x 6	7-8	6-7 <u>6-8</u>	5-11 <u>6-0</u>	5-5 <u>5-6</u>	5-0 <u>5-1</u>	4-8 <u>4-9</u>	4-5 <u>4-6</u>	
	3-2 x 8	10-3	8-10	7-11	7-3	6-8	6-3	5-11	
	3-2 x 10	12-6	10-10	9-8	8-10	8-2	7-8	7-2	
3-2 x 12	14-6	12-7	11-3	10-3	9-6	8-11	8-5		
Redwood ^h , Western Cedars ^h , Ponderosa Pine ^h , Red Pine ^h	1-2 x 6	4-2	3-7	3-1	2-7 <u>2-9</u>	2-2 <u>2-6</u>	1-10 <u>2-3</u>	1-8 <u>2-2</u>	
	1-2 x 8	5-4	4-7	4-1	3-4 <u>3-7</u>	2-10 <u>3-3</u>	2-6 <u>3-0</u>	2-2 <u>2-10</u>	
	1-2 x 10	6-6	5-7	5-0	4-3 <u>4-7</u>	3-8 <u>4-2</u>	3-2 <u>3-10</u>	2-9 <u>3-7</u>	
	1-2 x 12	7-6	6-6	5-10	5-3 <u>5-4</u>	4-5 <u>4-11</u>	3-10 <u>4-7</u>	3-5 <u>4-4</u>	
	2-2 x 6	6-2	5-4	4-10	4-5	4-1 <u>4-0</u>	3-9 <u>3-8</u>	3-4	
	2-2 x 8	7-10	6-10	6-1	5-7	5-2	4-10	4-4 <u>4-5</u>	
	2-2 x 10	9-7	8-4	7-5	6-9	6-3	5-10	5-6	
	2-2 x 12	11-1	9-8	8-7	7-10	7-3	6-10	6-5	
	3-2 x 6	7-8	6-9	6-0	5-6	5-1	4-9	4-6	
	3-2 x 8	9-10	8-6	7-7	6-11	6-5	6-0	5-8	
	3-2 x 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11	
3-2 x 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

- a. Interpolation permitted. Extrapolation not permitted.
- b. Beams supporting a single span of joists with or without cantilever.
- c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever Snow load not assumed to be concurrent with live load.
- d. No. 2 grade, wet service factor included.
- e. Beam depth shall be equal to or greater than the depth intersecting joist for a flush beam connection.
- f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
- g. Includes incising factor.
- h. Incising factor not included.
- i. Deck joist span as shown in Figure R507.5

TABLE R507.5(2)
MAXIMUM DECK BEAM SPAN - 50 PSF GROUND SNOW LOAD ^c

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN ^{g,h}						
		MAXIMUM BEAM SPAN ^{a,b,f}						
		(feet-inches)						
		Deck Joist Span ^{a,i}						
		6	8	10	12	14	16	18
Southern Pine	1-2x6	<u>4-2-4-6</u>	<u>3-8-3-11</u>	<u>3-3-3-6</u>	<u>2-11-3-2</u>	<u>2-9-2-11</u>	<u>2-5-2-9</u>	<u>2-2-2-7</u>
	1-2x8	<u>5-4-5-9</u>	<u>4-7-4-11</u>	<u>4-1-4-5</u>	<u>3-9-4-0</u>	<u>3-6-3-9</u>	<u>3-3-3-6</u>	<u>2-10-3-3</u>
	1-2x10	<u>6-4-6-9</u>	<u>5-6-5-10</u>	<u>4-11-5-3</u>	<u>4-6-4-9</u>	<u>4-2-4-5</u>	<u>3-10-4-2</u>	<u>3-8-3-11</u>
	1-2x12	<u>7-6-8-0</u>	<u>6-5-6-11</u>	<u>5-9-6-2</u>	<u>5-3-5-8</u>	<u>4-10-5-3</u>	<u>4-7-4-11</u>	<u>4-3-4-7</u>
	2-2x6	<u>6-3-6-8</u>	<u>5-5-5-9</u>	<u>4-10-5-2</u>	<u>4-5-4-9</u>	<u>4-1-4-4</u>	<u>3-10-4-1</u>	<u>3-7-3-10</u>
	2-2x8	<u>7-11-8-6</u>	<u>6-10-7-4</u>	<u>6-2-6-7</u>	<u>5-7-6-0</u>	<u>5-2-5-7</u>	<u>4-10-5-2</u>	<u>4-7-4-11</u>
	2-2x10	<u>9-5-10-1</u>	<u>8-2-8-9</u>	<u>7-3-7-10</u>	<u>6-8-7-1</u>	<u>6-2-6-7</u>	<u>5-9-6-2</u>	<u>5-5-5-10</u>
	2-2x12	<u>11-1-11-11</u>	<u>9-7-10-3</u>	<u>8-7-9-2</u>	<u>7-10-8-5</u>	<u>7-3-7-9</u>	<u>6-9-7-3</u>	<u>6-5-6-10</u>
	3-2x6	<u>7-10-7-11</u>	<u>6-9-7-2</u>	<u>6-1-6-6</u>	<u>5-6-5-11</u>	<u>5-1-5-6</u>	<u>4-9-5-1</u>	<u>4-6-4-10</u>
	3-2x8	<u>9-11-10-5</u>	<u>8-7-9-3</u>	<u>7-8-8-3</u>	<u>7-0-7-6</u>	<u>6-6-6-11</u>	<u>6-16-6-6</u>	<u>5-9-6-2</u>
	3-2x10	<u>11-9-12-8</u>	<u>10-2-10-11</u>	<u>9-1-9-9</u>	<u>8-4-8-11</u>	<u>7-8-8-3</u>	<u>7-2-7-9</u>	<u>6-9-7-3</u>
	3-2x12	<u>13-11-14-11</u>	<u>12-0-12-11</u>	<u>10-9-11-6</u>	<u>9-10-10-6</u>	<u>9-1-9-9</u>	<u>8-6-9-1</u>	<u>8-0-8-7</u>
Douglas fir-larch ^g , Hem-fir ^g , Spruce-pine-fir ^g	1-2x6	<u>3-9-4-0</u>	<u>3-3-3-5</u>	<u>2-6-2-11</u>	<u>2-1-2-7</u>	<u>1-9-2-4</u>	<u>1-6-2-2</u>	<u>1-4-2-0</u>
	1-2x8	<u>5-0-5-4</u>	<u>4-3-4-7</u>	<u>3-4-3-11</u>	<u>2-9-3-5</u>	<u>2-3-3-1</u>	<u>2-0-2-10</u>	<u>1-9-2-8</u>
	1-2x10	<u>6-1-6-7</u>	<u>5-4-5-8</u>	<u>4-3-4-11</u>	<u>3-6-4-5</u>	<u>2-11-4-0</u>	<u>2-6-3-8</u>	<u>2-3-3-5</u>
	1-2x12	<u>7-1-7-7</u>	<u>6-2-6-7</u>	<u>5-2-5-11</u>	<u>4-3-5-4</u>	<u>3-7-4-10</u>	<u>3-1-4-6</u>	<u>2-9-4-2</u>
	2-2x6	<u>5-7-6-0</u>	<u>4-10-5-2</u>	<u>4-4-4-7</u>	<u>3-11-4-2</u>	<u>3-6-3-10</u>	<u>3-0-3-5</u>	<u>2-8-3-2</u>
	2-2x8	<u>7-5-8-0</u>	<u>6-5-6-11</u>	<u>5-9-6-2</u>	<u>5-3-5-8</u>	<u>4-7-5-0</u>	<u>4-0-4-7</u>	<u>3-6-4-2</u>
	2-2x10	<u>9-1-9-9</u>	<u>7-10-8-5</u>	<u>7-0-7-7</u>	<u>6-5-6-11</u>	<u>5-11-6-4</u>	<u>5-1-5-10</u>	<u>4-6-5-4</u>
	2-2x12	<u>10-7-11-4</u>	<u>9-2-9-10</u>	<u>8-2-8-9</u>	<u>7-5-8-0</u>	<u>6-11-7-5</u>	<u>6-3-6-11</u>	<u>5-6-6-6</u>
	3-2x6	<u>7-0-7-6</u>	<u>6-0-6-6</u>	<u>5-5-5-9</u>	<u>4-11-5-3</u>	<u>4-7-4-11</u>	<u>4-3-4-7</u>	<u>4-0-4-4</u>
	3-2x8	<u>9-4-10-0</u>	<u>8-1-8-8</u>	<u>7-3-7-9</u>	<u>6-7-7-1</u>	<u>6-1-6-6</u>	<u>5-8-6-1</u>	<u>5-4-5-8</u>
	3-2x10	<u>11-5-12-3</u>	<u>9-10-10-7</u>	<u>8-10-9-6</u>	<u>8-1-8-8</u>	<u>7-5-8-0</u>	<u>7-0-7-6</u>	<u>6-7-7-0</u>
	3-2x12	<u>13-3-14-3</u>	<u>11-6-12-4</u>	<u>10-3-11-0</u>	<u>9-5-10-1</u>	<u>8-8-9-4</u>	<u>8-1-8-9</u>	<u>7-8-8-3</u>
Redwood ^h , Western Cedars ^h , Ponderosa Pine ^h , Red Pine ^h	1-2x6	<u>3-10-4-1</u>	<u>3-4-3-6</u>	<u>2-7-3-0</u>	<u>2-2-2-8</u>	<u>1-10-2-5</u>	<u>1-7-2-3</u>	<u>1-5-2-1</u>
	1-2x8	<u>4-10-5-2</u>	<u>4-2-4-6</u>	<u>3-5-4-0</u>	<u>2-10-3-6</u>	<u>2-4-3-2</u>	<u>2-1-2-11</u>	<u>1-10-2-9</u>
	1-2x10	<u>5-11-6-4</u>	<u>5-1-5-6</u>	<u>4-4-4-11</u>	<u>3-7-4-6</u>	<u>3-0-4-1</u>	<u>2-8-3-9</u>	<u>2-4-3-6</u>
	1-2x12	<u>6-10-7-4</u>	<u>5-11-6-4</u>	<u>5-4-5-8</u>	<u>4-4-5-2</u>	<u>3-8-4-10</u>	<u>3-2-4-6</u>	<u>2-10-4-3</u>
	2-2x6	<u>5-8-6-1</u>	<u>4-11-5-3</u>	<u>4-5-4-8</u>	<u>4-0-4-4</u>	<u>3-7-3-11</u>	<u>3-1-3-6</u>	<u>2-9-3-3</u>
	2-2x8	<u>7-2-7-8</u>	<u>6-3-6-8</u>	<u>5-7-5-11</u>	<u>5-1-5-5</u>	<u>4-8-5-0</u>	<u>4-1-4-8</u>	<u>3-8-4-3</u>
	2-2x10	<u>8-9-9-5</u>	<u>7-7-8-2</u>	<u>6-9-7-3</u>	<u>6-2-6-8</u>	<u>5-9-6-2</u>	<u>5-3-5-9</u>	<u>4-8-5-5</u>
	2-2x12	<u>10-2-10-11</u>	<u>8-10-9-5</u>	<u>7-10-8-5</u>	<u>7-2-7-8</u>	<u>6-8-7-2</u>	<u>6-3-6-8</u>	<u>5-8-6-3</u>
	3-2x6	7-1	<u>6-2-6-5</u>	<u>5-6-5-11</u>	<u>5-0-5-5</u>	<u>4-8-5-0</u>	<u>4-4-4-8</u>	<u>4-1-4-5</u>
	3-2x8	<u>9-0-9-4</u>	<u>7-9-8-4</u>	<u>6-11-7-5</u>	<u>6-4-6-10</u>	<u>5-11-6-4</u>	<u>5-6-5-11</u>	<u>5-2-5-7</u>
	3-2x10	<u>11-0-11-9</u>	<u>9-6-10-2</u>	<u>8-6-9-1</u>	<u>7-9-8-4</u>	<u>7-2-7-8</u>	<u>6-9-7-2</u>	<u>6-4-6-9</u>
	3-2x12	<u>12-9-13-8</u>	<u>11-0-11-10</u>	<u>9-10-10-7</u>	<u>9-0-9-8</u>	<u>8-4-8-11</u>	<u>7-9-8-4</u>	<u>7-4-7-10</u>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

- a. Interpolation allowed. Extrapolation is not allowed.
- b. Beams supporting a single span of joists with or without cantilever.
- c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.
- d. No. 2 grade, wet service factor included.
- e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.
- f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
- g. Includes incising factor
- h. Incising factor not included.
- i. Deck joist span as shown in Figure R507.5

**TABLE R507.5(3)
MAXIMUM DECK BEAM SPAN - 60 PSF GROUND SNOW LOAD ^c**

Portions of table not shown remain unchanged.

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN ^{a,h} (feet)- <u>MAXIMUM BEAM SPAN ^{a,b,f}</u> (feet-inches) <u>Deck Joist Span ^{a,i}</u> (feet)								
		6	8	10	12	14	16	18		
		Southern Pine	1-2x6	<u>3-11 4-2</u>	<u>3-4 3-7</u>	<u>3-0 3-3</u>	<u>2-9 2-11</u>	<u>2-5 2-9</u>	<u>2-1 2-6</u>	<u>1-10 2-5</u>
			1-2x8	<u>4-11 5-3</u>	<u>4-3 4-7</u>	<u>3-10 4-1</u>	<u>3-6 3-9</u>	<u>3-2 3-5</u>	<u>2-9 3-3</u>	<u>2-5 3-0</u>
1-2x10	<u>5-10 6-3</u>		<u>5-1 5-5</u>	<u>4-6 4-10</u>	<u>4-2 4-5</u>	<u>3-10 4-1</u>	<u>3-6 3-10</u>	<u>3-1 3-7</u>		
1-2x10	<u>6-11 7-5</u>		<u>6-0 6-5</u>	<u>5-4 5-9</u>	<u>4-10 5-3</u>	<u>4-6 4-10</u>	<u>4-3 4-6</u>	<u>3-10 4-3</u>		
2-2x6	<u>5-9 6-2</u>		<u>5-0 5-4</u>	<u>4-6 4-9</u>	<u>4-1 4-4</u>	<u>3-9 4-0</u>	<u>3-6 3-9</u>	<u>3-4 3-7</u>		
2-2x8	<u>7-4 7-10</u>		<u>6-4 6-10</u>	<u>5-8 6-1</u>	<u>5-2 5-7</u>	<u>4-9 5-2</u>	<u>4-6 4-10</u>	<u>4-3 4-6</u>		
2-2x10	<u>8-8 9-4</u>		<u>7-6 8-1</u>	<u>6-9 7-3</u>	<u>6-2 6-7</u>	<u>5-8 6-1</u>	<u>5-4 5-8</u>	<u>5-0 5-4</u>		
2-2x12	<u>10-3 11-0</u>		<u>8-11 9-6</u>	<u>7-11 8-6</u>	<u>7-3 7-9</u>	<u>6-8 7-2</u>	<u>6-3 6-9</u>	<u>5-11 6-4</u>		
3-2x6	<u>7-3 7-5</u>		<u>6-3 6-9</u>	<u>5-7 6-0</u>	<u>5-1 5-6</u>	<u>4-9 5-1</u>	<u>4-5 4-9</u>	<u>4-2 4-6</u>		
3-2x8	<u>9-2 9-9</u>		<u>7-11 8-6</u>	<u>7-1 7-8</u>	<u>6-6 6-11</u>	<u>6-0 6-5</u>	<u>5-7 6-0</u>	<u>5-3 5-8</u>		
3-2x10	<u>10-11 11-8</u>		<u>9-5 10-2</u>	<u>8-5 9-1</u>	<u>7-8 8-3</u>	<u>7-2 7-8</u>	<u>6-8 7-2</u>	<u>6-3 6-9</u>		
3-2x12	<u>12-10 13-9</u>		<u>11-2 11-11</u>	<u>9-11 10-8</u>	<u>9-1 9-9</u>	<u>8-5 9-0</u>	<u>7-10 8-5</u>	<u>7-5 7-11</u>		
Douglas fir-larch ^g , Hem-fir ^g , Spruce-pine-fir ^g	1-2x6	<u>3-5 3-8</u>	<u>2-9 3-1</u>	<u>2-2 2-8</u>	<u>1-9 2-4</u>	<u>1-6 2-2</u>	<u>1-3 2-0</u>	<u>1-1 1-10</u>		
	1-2x8	<u>4-8 5-0</u>	<u>3-8 4-1</u>	<u>2-10 3-6</u>	<u>2-4 3-1</u>	<u>1-11 2-10</u>	<u>1-8 2-7</u>	<u>1-6 2-5</u>		
	1-2x10	<u>5-8 6-1</u>	<u>4-8 5-2</u>	<u>3-8 4-6</u>	<u>3-0 4-0</u>	<u>2-6 3-7</u>	<u>2-2 3-4</u>	<u>1-11 3-2</u>		
	1-2x12	<u>6-7 7-1</u>	<u>5-8 6-1</u>	<u>4-5 5-5</u>	<u>3-7 4-10</u>	<u>3-1 4-5</u>	<u>2-7 4-1</u>	<u>2-3 3-10</u>		
	2-2x6	<u>5-2 5-6</u>	<u>4-5 4-9</u>	<u>4-0 4-3</u>	<u>3-6 3-10</u>	<u>3-0 3-5</u>	<u>1-11 3-1</u>	<u>1-8 2-10</u>		
	2-2x8	<u>6-11 7-5</u>	<u>5-11 6-5</u>	<u>5-4 5-9</u>	<u>4-8 5-0</u>	<u>3-11 4-6</u>	<u>3-5 4-1</u>	<u>3-0 3-9</u>		
	2-2x10	<u>8-5 9-0</u>	<u>7-3 7-10</u>	<u>6-6 7-0</u>	<u>5-11 6-4</u>	<u>5-1 5-9</u>	<u>4-5 5-2</u>	<u>3-10 4-10</u>		
	2-2x12	<u>9-9 10-6</u>	<u>8-5 9-1</u>	<u>7-7 8-1</u>	<u>6-11 7-5</u>	<u>6-2 6-10</u>	<u>5-4 6-4</u>	<u>4-8 5-10</u>		
	3-2x6	<u>6-5 6-11</u>	<u>5-7 6-0</u>	<u>5-0 5-4</u>	<u>4-7 4-11</u>	<u>4-3 4-6</u>	<u>3-11 4-2</u>	<u>3-5 3-10</u>		
	3-2x8	<u>8-8 9-3</u>	<u>7-6 8-0</u>	<u>6-8 7-2</u>	<u>6-1 6-6</u>	<u>5-8 6-1</u>	<u>5-2 5-6</u>	<u>4-7 5-0</u>		
	3-2x10	<u>10-7 11-4</u>	<u>9-2 9-10</u>	<u>8-2 8-9</u>	<u>7-5 8-0</u>	<u>6-11 7-5</u>	<u>6-5 6-11</u>	<u>5-10 6-5</u>		
	3-2x12	<u>12-3 13-2</u>	<u>10-8 11-5</u>	<u>9-6 10-2</u>	<u>8-8 9-4</u>	<u>8-0 8-7</u>	<u>7-6 8-1</u>	<u>7-1 7-7</u>		
Redwood ^h , Western Cedars ^h , Ponderosa Pine ^h , Red Pine ^h	1-2x6	<u>3-6 3-9</u>	<u>2-10 3-2</u>	<u>2-3 2-9</u>	<u>1-10 2-5</u>	<u>1-7 2-2</u>	<u>1-4 2-0</u>	<u>1-2 1-11</u>		
	1-2x8	<u>4-6 4-10</u>	<u>3-9 4-2</u>	<u>2-11 3-7</u>	<u>2-5 3-2</u>	<u>2-0 2-11</u>	<u>1-9 2-8</u>	<u>1-7 2-6</u>		
	1-2x10	<u>5-6 5-10</u>	<u>4-9 5-1</u>	<u>3-9 4-6</u>	<u>3-1 4-1</u>	<u>2-7 3-8</u>	<u>2-3 3-5</u>	<u>2-0 3-3</u>		
	1-2x12	<u>6-4 6-10</u>	<u>5-6 5-11</u>	<u>4-7 5-3</u>	<u>3-9 4-10</u>	<u>3-2 4-5</u>	<u>2-9 4-2</u>	<u>2-5 3-11</u>		
	2-2x6	<u>5-3 5-7</u>	<u>4-6 4-10</u>	<u>4-1 4-4</u>	<u>3-8 3-11</u>	<u>3-1 3-6</u>	<u>2-8 3-2</u>	<u>2-4 2-11</u>		
	2-2x8	<u>6-8 7-1</u>	<u>5-9 6-2</u>	<u>5-2 5-6</u>	<u>4-8 5-0</u>	<u>4-1 4-7</u>	<u>3-6 4-2</u>	<u>3-1 3-10</u>		
	2-2x10	<u>8-1 8-8</u>	<u>7-0 7-6</u>	<u>6-3 6-9</u>	<u>5-9 6-2</u>	<u>5-2 5-8</u>	<u>4-6 5-4</u>	<u>4-0 4-11</u>		
	2-2x12	<u>9-5 10-1</u>	<u>8-2 8-9</u>	<u>7-3 7-10</u>	<u>6-8 7-2</u>	<u>6-2 6-7</u>	<u>5-6 6-2</u>	<u>4-10 5-10</u>		
	3-2x6	<u>6-7 6-8</u>	<u>5-8 6-1</u>	<u>5-1 5-5</u>	<u>4-8 5-0</u>	<u>4-4 4-7</u>	<u>4-0 4-3</u>	<u>3-7 3-11</u>		
	3-2x8	<u>8-4 8-9</u>	<u>7-2 7-9</u>	<u>6-5 6-11</u>	<u>5-11 6-4</u>	<u>5-5 5-10</u>	<u>5-1 5-5</u>	<u>4-8 5-2</u>		
	3-2x10	<u>10-2 10-11</u>	<u>8-10 9-5</u>	<u>7-10 8-5</u>	<u>7-2 7-8</u>	<u>6-8 7-2</u>	<u>6-3 6-8</u>	<u>5-10 6-3</u>		
	3-2x12	<u>11-9 12-8</u>	<u>10-2 10-11</u>	<u>9-1 9-9</u>	<u>8-4 8-11</u>	<u>7-8 8-3</u>	<u>7-3 7-9</u>	<u>6-10 7-3</u>		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

- a. Interpolation allowed. Extrapolation is not allowed.
- b. Beams supporting a single span of joists with or without cantilever.
- c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.
- d. No. 2 grade, wet service factor included.
- e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.
- f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
- g. Includes incising factor
- h. Incising factor not included.
- i. Deck joist span as shown in Figure R507.5

**TABLE R507.5(4)
MAXIMUM DECK BEAM SPAN - 70 PSF GROUND SNOW LOAD ^c**

BEAM SPECIES ^d	BEAM SIZE ^e	DECK JOIST SPAN (feet) ^{a,i}						
		MAXIMUM BEAM SPAN a.b.f (feet-inches)						
		Deck Joist Span ^{aj}						
		(feet)						
		6	8	10	12	14	16	18
Southern Pine	1-2x6	<u>3-8 3-11</u>	<u>3-2 3-4</u>	<u>2-10 3-0</u>	<u>2-1 2-9</u>	<u>1-10 2-6</u>	<u>1-4 2-4</u>	<u>1-7 2-3</u>
	1-2x8	<u>4-7 4-11</u>	<u>4-0 4-3</u>	<u>3-7 3-10</u>	<u>3-3 3-6</u>	<u>2-9 3-3</u>	<u>2-5 3-0</u>	<u>2-2 2-10</u>
	1-2x10	<u>5-6 5-10</u>	<u>4-9 5-1</u>	<u>4-3 4-6</u>	<u>3-10 4-2</u>	<u>3-7 3-10</u>	<u>3-1 3-7</u>	<u>2-9 3-4</u>
	1-2x12	<u>6-5 6-11</u>	<u>5-7 6-0</u>	<u>5-0 5-4</u>	<u>4-7 4-11</u>	<u>4-3 4-6</u>	<u>3-9 4-3</u>	<u>3-4 4-0</u>
	2-2x6	<u>5-5 5-9</u>	<u>4-8 5-0</u>	<u>4-2 4-6</u>	<u>3-10 4-1</u>	<u>3-6 3-9</u>	<u>3-3 3-6</u>	<u>3-1 3-4</u>
	2-2x8	<u>6-10 7-4</u>	<u>5-11 6-4</u>	<u>5-4 5-8</u>	<u>4-10 5-2</u>	<u>4-6 4-10</u>	<u>4-2 4-6</u>	<u>3-11 4-3</u>
	2-2x10	<u>8-2 8-9</u>	<u>7-1 7-7</u>	<u>6-4 6-9</u>	<u>5-9 6-2</u>	<u>5-4 5-8</u>	<u>5-0 5-4</u>	<u>4-8 5-0</u>
	2-2x12	<u>9-7 10-3</u>	<u>8-4 8-11</u>	<u>7-5 8-0</u>	<u>6-9 7-3</u>	<u>6-3 6-9</u>	<u>5-10 6-3</u>	<u>5-6 5-11</u>
	3-2x6	<u>6-9 7-0</u>	<u>5-10 6-3</u>	<u>5-3 5-7</u>	<u>4-9 5-1</u>	<u>4-5 4-9</u>	<u>4-2 4-5</u>	<u>3-11 4-2</u>
	3-2x8	<u>8-7 9-3</u>	<u>7-5 8-0</u>	<u>6-8 7-2</u>	<u>6-1 6-6</u>	<u>5-7 6-0</u>	<u>5-3 5-8</u>	<u>4-11 5-4</u>
	3-2x10	<u>10-2 10-11</u>	<u>8-10 9-6</u>	<u>7-11 8-6</u>	<u>7-2 7-9</u>	<u>6-8 7-2</u>	<u>6-3 6-8</u>	<u>5-10 6-4</u>
3-2x12	<u>12-0 12-11</u>	<u>10-5 11-2</u>	<u>9-4 10-0</u>	<u>8-6 9-1</u>	<u>7-10 8-5</u>	<u>7-4 7-11</u>	<u>6-11 7-5</u>	
Douglas fir-larch ^g , Hem-fir ^g , Spruce -pine-fir ^g	1-2x6	<u>3-3 3-5</u>	<u>2-5 2-10</u>	<u>1-10 2-5</u>	<u>1-6 2-2</u>	<u>1-3 2-0</u>	<u>1-1 1-10</u>	<u>1-0 1-9</u>
	1-2x8	<u>4-4 4-7</u>	<u>3-2 3-8</u>	<u>2-6 3-2</u>	<u>2-0 2-10</u>	<u>1-8 2-7</u>	<u>1-6 2-5</u>	<u>1-4 2-4</u>
	1-2x10	<u>5-4 5-8</u>	<u>4-1 4-9</u>	<u>3-2 4-1</u>	<u>2-7 3-8</u>	<u>2-2 3-4</u>	<u>1-11 3-1</u>	<u>1-8 2-11</u>
	1-2x12	<u>6-2 6-7</u>	<u>5-0 5-8</u>	<u>3-10 5-0</u>	<u>3-2 4-6</u>	<u>2-8 4-1</u>	<u>2-4 3-10</u>	<u>2-0 3-7</u>
	2-2x6	<u>4-10 5-2</u>	<u>4-2 4-6</u>	<u>3-9 4-0</u>	<u>3-1 3-5</u>	<u>2-7 3-1</u>	<u>2-3 2-10</u>	<u>2-0 2-7</u>
	2-2x8	<u>6-5 6-11</u>	<u>5-7 6-0</u>	<u>5-0 5-3</u>	<u>4-1 4-7</u>	<u>3-5 4-1</u>	<u>3-0 3-8</u>	<u>2-8 3-5</u>
	2-2x10	<u>7-10 8-5</u>	<u>6-10 7-4</u>	<u>6-1 6-6</u>	<u>5-9 5-10</u>	<u>4-5 5-2</u>	<u>3-10 4-9</u>	<u>3-5 4-5</u>
	2-2x12	<u>9-2 9-10</u>	<u>7-11 8-6</u>	<u>7-1 7-7</u>	<u>6-4 6-11</u>	<u>5-5 6-4</u>	<u>4-8 5-9</u>	<u>4-1 5-4</u>
	3-2x6	<u>6-0 6-6</u>	<u>5-3 5-7</u>	<u>4-8 5-0</u>	<u>4-3 4-7</u>	<u>3-11 4-2</u>	<u>3-5 3-9</u>	<u>3-0 3-5</u>
	3-2x8	<u>8-1 8-8</u>	<u>7-0 7-6</u>	<u>6-3 6-8</u>	<u>5-8 6-1</u>	<u>5-2 5-6</u>	<u>4-6 5-0</u>	<u>4-0 4-7</u>
	3-2x10	<u>9-10 10-7</u>	<u>8-6 9-2</u>	<u>7-8 8-2</u>	<u>7-0 7-6</u>	<u>6-5 6-11</u>	<u>5-9 6-4</u>	<u>5-1 5-10</u>
3-2x12	<u>11-6 12-4</u>	<u>9-11 10-8</u>	<u>8-11 9-7</u>	<u>8-1 8-9</u>	<u>7-6 8-1</u>	<u>7-0 7-7</u>	<u>6-3 7-1</u>	
Redwood ^h , Western Cedars ^h , Ponderosa Pine ^h , Red Pine ^h	1-2x6	<u>3-4 3-6</u>	<u>2-6 2-11</u>	<u>1-11 2-6</u>	<u>1-7 2-3</u>	<u>1-4 2-0</u>	<u>1-2 1-11</u>	<u>1-0 1-9</u>
	1-2x8	<u>4-2 4-6</u>	<u>3-3 3-10</u>	<u>2-7 3-3</u>	<u>2-1 2-11</u>	<u>1-9 2-8</u>	<u>1-7 2-6</u>	<u>1-4 2-4</u>
	1-2x10	<u>5-1 5-6</u>	<u>4-2 4-9</u>	<u>3-3 4-2</u>	<u>2-8 3-9</u>	<u>2-3 3-5</u>	<u>2-0 3-2</u>	<u>1-9 3-0</u>
	1-2x12	<u>5-11 6-4</u>	<u>5-1 5-6</u>	<u>4-0 4-11</u>	<u>3-3 4-6</u>	<u>2-9 4-2</u>	<u>2-5 3-11</u>	<u>2-1 3-8</u>
	2-2x6	<u>4-11 5-3</u>	<u>4-3 4-7</u>	<u>3-10 4-1</u>	<u>3-2 3-6</u>	<u>2-8 3-2</u>	<u>2-4 2-11</u>	<u>2-1 2-8</u>
	2-2x8	<u>6-3 6-8</u>	<u>5-5 5-9</u>	<u>4-10 5-2</u>	<u>4-2 4-8</u>	<u>3-7 4-2</u>	<u>3-1 3-10</u>	<u>2-9 3-6</u>
	2-2x10	<u>7-7 8-2</u>	<u>6-7 7-1</u>	<u>5-10 6-4</u>	<u>5-4 5-9</u>	<u>4-7 5-4</u>	<u>3-11 4-10</u>	<u>3-6 4-6</u>
	2-2x12	<u>8-10 9-5</u>	<u>7-7 8-2</u>	<u>6-10 7-4</u>	<u>6-3 6-8</u>	<u>5-6 6-2</u>	<u>4-10 5-9</u>	<u>4-3 5-5</u>
	3-2x6	<u>6-2 6-4</u>	<u>5-4 5-8</u>	<u>4-9 5-1</u>	<u>4-4 4-8</u>	<u>4-0 4-3</u>	<u>3-6 3-10</u>	<u>3-1 3-6</u>
	3-2x8	<u>7-9 8-4</u>	<u>6-9 7-3</u>	<u>6-0 6-5</u>	<u>5-6 5-11</u>	<u>5-1 5-5</u>	<u>4-8 5-1</u>	<u>4-1 4-8</u>
	3-2x10	<u>9-6 10-2</u>	<u>8-3 8-10</u>	<u>7-4 7-11</u>	<u>6-9 7-2</u>	<u>6-3 6-8</u>	<u>5-10 6-3</u>	<u>5-3 5-11</u>
3-2x12	<u>11-0 11-10</u>	<u>9-6 10-3</u>	<u>8-6 9-2</u>	<u>7-9 8-4</u>	<u>7-3 7-9</u>	<u>6-9 7-3</u>	<u>6-4 6-10</u>	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

- a. Interpolation allowed. Extrapolation is not allowed.
- b. Beams supporting a single span of joists with or without cantilever.
- c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.
- d. No. 2 grade, wet service factor included.
- e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.
- f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
- g. Includes incising factor
- h. Incising factor not included.
- i. Deck joist span as shown in Figure R507.5

**TABLE R507.6
MAXIMUM DECK JOIST SPANS**

LOAD ^a (psf)	JOIST SPECIES ^b	JOIST SIZE	ALLOWABLE JOIST SPAN ^{b,c}			MAXIMUM CANTILEVER ^{f,g}							
			(feet-inches)			(feet-inches)							
			Joist Spacing			Adjacent Joist Back Span ^g							
			(inches)			(feet)							
			12	16	24	4	6	8	10	12	14	16	18
40 Live Load	Southern Pine	2x6	9-11	9-0	7-7	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	2-3	NP	NP	NP
		2x10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-4	3-4	NP
		2x12	18-0	16-6	13-6	1-0	1-6	2-0	2-6	3-0	3-6	4-0	4-1
	Douglas fir-larch ^e ,	2x6	9-6	8-4	6-10	1-0	1-6	1-4	NP	NP	NP	NP	NP
		Hem-fir ^e ,	2x8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	2-0	NP	NP
	Spruce-pine-fir ^e		2x10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	3-0	3-3	NP
		2x12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	3-0	3-6	3-11	3-11
	Redwood ^f ,		2x6	8-10	8-0	6-10	1-0	1-4	1-1	NP	NP	NP	NP
		Western Cedars ^f ,	2x8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	NP	NP	NP
	2x10		14-11	13-0	10-7	1-0	1-6	2-0	2-6	3-0	2-9	NP	NP
		Ponderosa Pine ^f ,	2x12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8
50 Ground Snow Load	Southern Pine	2x6	9-2	8-4	7-4	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	12-1	11-0	9-7 9-5	1-0	1-6	2-0	2-5	2-3	NP	NP	NP
		2x10	15-5	14-1 13-9	12-3 11-3	1-0	1-6	2-0	2-6	3-0	3-1	NP	NP
		2x12	18-0	17-1 16-2	14-6 13-2	1-0	1-6	2-0	2-6	3-0	3-6	3-10	3-10
	Douglas fir-larch ^e ,	2x6	8-10	8-0	7-0 6-8	1-0	1-6	1-4	NP	NP	NP	NP	NP
		Hem-fir ^e ,	2x8	11-7	10-7	9-3 8-11	1-0	1-6	2-0	2-3	NP	NP	NP
	2x10		14-10	13-6 13-3	11-9 10-10	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP
		2x12	18-0 17-9	16-5 15-5	13-9 12-7	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
	Redwood ^f ,		2x6	8-3	7-6	6-8 6-6	1-0	1-4	1-1	NP	NP	NP	NP
		Western Cedars ^f ,	2x8	10-10	9-10	8-7 8-6	1-0	1-6	2-0	1-11	NP	NP	NP
	2x10		13-10	12-7	11-0 10-5	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		Ponderosa Pine ^f ,	2x12	16-10	15-3 14-9	13-2 12-1	1-0	1-6	2-0	2-6	3-0	3-5	3-5
60 Ground Snow Load	Southern Pine	2x6	8-8	7-10	6-10	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	11-5	10-4	9-1 8-9	1-0	1-6	2-0	2-4	NP	NP	NP	NP
		2x10	14-7	13-3 12-9	11-7 10-5	1-0	1-6	2-0	2-6	2-11	2-11	NP	NP
		2x12	17-8 17-3	16-1 15-0	14-0 12-3	1-0	1-6	2-0	2-6	3-0	3-6	3-7	NP
	Douglas fir-larch ^e ,	2x6	8-4	7-6	6-7 6-2	1-0	1-6	1-4	NP	NP	NP	NP	NP
		Hem-fir ^e ,	2x8	10-11	9-11	8-8 8-3	1-0	1-6	2-0	2-2	NP	NP	NP
	2x10		13-11	12-8 12-4	11-1 10-0	1-0	1-6	2-0	2-6	2-10	NP	NP	NP
		2x12	17-0 16-6	15-5 14-3	13-6 11-8	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Redwood ^f ,		2x6	7-9	7-0	6-2	1-0	1-4	NP	NP	NP	NP	NP
		Western Cedars ^f ,	2x8	10-2	9-3	8-1 7-11	1-0	1-6	2-0	1-11	NP	NP	NP
	2x10		13-0	11-10 11-9	10-4 9-7	1-0	1-6	2-0	2-6	2-7	NP	NP	NP
		Ponderosa Pine ^f ,											

	Red Pine ^f	2x12	15-10 15-9	14-4 13-8	12-7 11-2	1-0	1-6	2-0	2-6	3-0	3-2	NP	NP
70	Southern Pine	2x6	8-3	7-6	6-6 6-5	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	10-10	9-10	8-7 8-2	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2x10	13-10 13-9	12-7 11-11	11-0 9-9	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2x12	16-10 16-2	15-3 14-0	13-4 11-5	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
Ground	Douglas fir-larch ^e ,	2x6	7-11	7-2 7-1	6-3 5-9	1-0	1-6	NP	NP	NP	NP	NP	NP
	Hem-fir ^e ,	2x8	10-5	9-5	8-3 7-8	1-0	1-6	2-0	2-1	NP	NP	NP	NP
Snow	Spruce-pine-fir ^e	2x10	13-3	12-0 11-6	10-6 9-5	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
		2012	16-4 15-5	14-8 13-4	12-10 10-11	1-0	1-6	2-0	2-6	3-0	3-3	3-3 NP	NP
Load	Redwood ^f ,	2x6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP
	Western Cedars ^f ,	2x8	9-8	8-10	7-8 7-4	1-0	1-6	1-11	NP	NP	NP	NP	NP
		2x10	12-4	11-3 11-0	9-10 9-0	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
	Ponderosa Pine ^f ,	2x12	15-0 14-9	13-8 12-9	11-11 10-5	1-0	1-6	2-0	2-6	2-0 3-0	3-0	NP	NP
	Red Pine ^f												

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg. NP = Not Permitted

a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.

b. No. 2 grade, wet service factor included.

c. L/Δ = 360 at main span.

d. L/Δ = 180 at cantilever with 220-pound point load applied to end.

e. Includes incising factor.

f. Incising factor not included.

g. Interpolation permitted. Extrapolation is not permitted.

**TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST**

LOAD ^c (psf)	JOIST SPAN ^a (feet)	<u>On-CENTER SPACING OF FASTENERS ^b</u> (inches)		
		¹ / ₂ -inch diameter lag screw with ¹ / ₂ -inch maximum sheathing ^{d, e}	¹ / ₂ -inch diameter bolt with ¹ / ₂ -inch maximum sheathing ^e	¹ / ₂ -inch diameter bolt with 1-inch maximum sheathing ^f
		40 Live Load	6	30
8	23		36	36
10	18		34	29
12	15		29	24
14	13		24	21
16	11		21	18
18	10		19	16
50 Ground Snow Load	6	29	36	36
	8	22	36	35
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
60 Ground Snow Load	6	25	36	36
	8	18	35	30
	10	17 <u>15</u>	33 <u>28</u>	28 <u>24</u>
	12	14 <u>12</u>	27 <u>23</u>	23 <u>20</u>
	14	12 <u>10</u>	23 <u>20</u>	20 <u>17</u>
	16	11 <u>9</u>	20 <u>17</u>	17 <u>15</u>
	18	9 <u>8</u>	18 <u>15</u>	15 <u>13</u>
70 Ground Snow Load	6	22	36	35
	8	16	31	26
	10	13	25	21
	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted. Extrapolation is not permitted.

b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.

c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.

d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.

e. Sheathing shall be wood structural panel or solid sawn lumber.

f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

Commenter's Reason: RB184-19 was solely prepared to increase the functionality of Section R507. Its purpose is to expand the tables for those parts of the country where the snow loads exceed the 40psf floor live load. The DCC amended the tables to account for 50, 60 and 70 psf snow loads. The code action committee praised the DCC for its "inclusion of engineers in the effort was as a positive aspect for this proposal." The DCC offered a floor modification at the CAH to amend some of the figures in the tables, but the committee did not accept them based on the volume of pages. They recommended that the DCC resubmit a public comment to correct the tables as necessary. The DCC has amended the figures, typos and a few format changes to correct these oversights.

While the public comment looks formidable, the scope of RB184-19 is very straightforward. The DCC recommends that you approve the proposal so a large part of the country, where snow loads exceed live floor loads, may be able to use Section R507.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. By adding additional loading values, designers will not need to hire an engineer to size the structural members.

Staff Analysis: There are four public comments to RB184, three which ask for replacements of parts of the proposal, and one asking for it to be modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1234

RB185-19

IRC: R312.1.4, 507.10 through 507.10.4(New)

Proposed Change as Submitted

Proponents: Deck Code Coalition, Charles Bajnai (chair), North American Deck and Railing Assoc (NADRA), Retired from Chesterfield County, VA, representing Deck Code Coalition (csbajnai@gmail.com)

2018 International Residential Code

Revise as follows:

R312.1.4 Exterior ~~plastic composite~~ guards. ~~Plastic composite exterior~~ Exterior guards shall comply with the requirements of Section ~~R317.4-~~ R507.10.

Add new text as follows:

R507.10 Exterior guards. Guards shall be constructed to meet the requirements of Section R301.5, R312 and this section.

R507.10.1 Support of guards. Where guards are supported on deck framing, guard loads shall be transferred to the deck framing with a continuous load path to the deck joists.

R507.10.1.1 Guards supported by side of deck framing. Where guards are connected to the interior or exterior side of a deck joist or beam, the joist or beam shall be connected to the adjacent joists to prevent rotation of the joist or beam. Connections relying only on fasteners in end grain withdrawal are not permitted.

R507.10.1.2 Guards supported on top of deck framing. Where guards are mounted on top of the decking, the guards shall be connected to the deck framing or blocking and installed in accordance with approved manufacturer's instructions to transfer the guard loads to the adjacent joists.

R507.10.2 Wood guards. Wood posts supporting guard loads shall be a minimum 4x4. Such 4x4 wood posts supporting guard loads shall not be notched at the connection to the supporting structure.

R507.10.3 Plastic composite guards. Plastic composite guards shall comply with the provisions of Section R507.2.2.

R507.10.4 Other guards. Other approved guards shall be in accordance with manufacturer's instructions or in accordance with accepted engineering principles.

Reason: The Deck Code Coalition submits this code change to include direction for constructing exterior guards on decks where the code is currently silent. Guards provide the first line of defense against significant falls, which can result in serious and sometimes fatal injuries. Exterior guards on decks, particularly the connection of the guard system to the deck framing, are rarely engineered and even more rarely tested in a manner that proves that they are adequate to meet the requirements of Table R301.5. Exterior guards and the framing supporting them are susceptible to deterioration, and therefore require a level of care that we think should be addressed in the code.

While the language of the proposal does not define a prescriptive detail for either guard construction or a guard connection to deck framing, the intent of the language is to guide both the builder and the building officials toward an understanding of the behavior of the guard and the structure supporting the guard. The language provides guidance for developing details that will resist the action of a guard on the deck framing when the guard is protecting an occupant from falling to a lower level. This proposal should save lives.

Cost Impact: The code change proposal will increase the cost of construction

Current building practices may not meet the requirements of Table R301.5 when typical code-required safety factors are applied, it is reasonable to assume that there will be an increase in cost as the construction techniques and details of these elements are modified to meet the proposed language. A direct result will likely be an increase in the number of fasteners, blocking labor associated with the construction of exterior guards. For those currently construction code-compliant guards, there will be little, if any, additional costs.

For those that need to update their construction techniques and wish to do so using proprietary fasteners, the material cost increase may be approximately \$20 per post, or approximately \$140 for a 12 foot by 12 foot attached deck. The extra cost has to be weighed against the increased safety and potential life savings that will occur across the country over many years.

RB185-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R507.10.1.2 Guards supported on top of deck framing. Where guards are mounted on top of the decking, the guards shall be connected to the deck framing or blocking and installed in accordance with ~~approved~~ manufacturer's instructions to transfer the guard loads to the adjacent joists.

R507.10.2 Wood posts at deck guards. ~~Wood posts supporting guard loads shall be a minimum 4x4. Such 4x4 wood posts supporting guard loads~~ applied to the top of the guard shall not be notched at the connection to the supporting structure.

R507.10.4 Other guards. Other ~~approved~~ guards shall be in accordance with manufacturer's instructions or in accordance with accepted engineering principles.

Committee Reason: The modification to Section R507.10.1.2 removed 'approved' because this adjective cannot be applied to manufacture's instructions. The modification to Section to R507.10.2 reworded the two sentences for clarity. The modification to Section R507.10.4 removes 'approved' because this would be confusing to the home owner. The proposal provided good general prescriptive language for guards that will reduce the need for engineering of guards. The committee had several suggestions for better wording that should come forward in a public comment: Add 'also' to Section R312.1.4; 'design' instead of 'construction' in Section 507.10; revise 'prevent' to 'limit' in Section R507.10.1.1; joists are part of the deck framing, so the language in Section R507.10.1 is confusing. (Vote: 9-2)

Assembly Action:

None

RB185-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R312.1.4

Proponents:

Thomas Zuzik Jr, of Railingcodes.com; Representing NOMMA - The National Ornamental and Miscellaneous Metals, representing NOMMA - The National Ornamental and Miscellaneous Metals Association (coderep@railingcodes.com); Charles Bajnai (csbajnai@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R312.1.4 Exterior Plastic Composite guards. Plastic composite exterior ~~Exterior~~ *guards* shall comply with the requirements of Section ~~R507.10~~ R317.4.

Commenter's Reason: Requesting through public comment to return section R312.1.4 back to the 2018 text.

The proponents of RB185-19 changed the language in R312.1.4 from "Exterior plastic composite guards" to "Exterior Guards", which is only a small part of the code change.

With changing the text from "exterior plastic composite guards" to all "exterior guards" for R312.1.4, this requires all exterior guards to go to the wood deck section in R507. Why are all exterior guards being sent to the wood deck section within the IRC?

Example: A new home with a masonry front porch and masonry stair flight, a side entrance porch and stair flight which is also masonry, a rear raised patio constructed of concrete dry laid blocks and concrete pavers and a second floor bi-parting exterior door that opens on to a metal fabricated balcony deck with a metal guard. All of the area's noted require guards because they exceed 30-inches in vertical height. However none of the required guard locations listed are wood nor a deck. So why is RB185-19 sending all exterior guards to the wood deck section?

Simply it shouldn't and by reverting back to the 2018 text just for R312.1.4 the rest of the proponents code change stays intact for RB185-19 and removes the conflict within the code that we believe was an unintended consequence of the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The effect of this public comment would be no change to the requirements for plastic composite guards. See the cost impact of the original proposal for other guards.

RB193-19

IRC@: TABLE R602.3(1) (New)

Proposed Change as Submitted

Proponents: Rick Allen, International Staple, Nail and Tool Association, representing International Staple, Nail and Tool Association
(rallen@isanta.org)

2018 International Residential Code

Revise as follows:

**TABLE R602.3(1)
FASTENING SCHEDULE**

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER^{a, b, c}	SPACING AND LOCATION
Roof			
1	Blocking between ceiling joists or rafters <u>or trusses to top plate or other framing below</u>	4-8d box (2½" × 0.113") or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3- 3" 14 gage staples 7/16" crown	Toe nail
	<u>Blocking between rafters or truss not at the wall top plate, to rafter or truss</u>	2-8d common (2½" x 0.131"); or 2- (3" x 0.131") nails or 2- 3" 14 gage staples 7/16" crown	<u>Each end toe nail</u>
		2-16d common (3½" x 0.162"); or 3-(3" x 0.131") nails or 3 -3" 14 gage staples 7/16" crown	<u>End nail</u>
	<u>Flat blocking to truss and web filler</u>	16d common (3½" x 0.162"); or (3" x 0.131") nails; or 3" 14 gage staples 7/16" crown	<u>6" o.c. Face nail</u>
2	Ceiling joists to top plate	<u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> 4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3- 3" 14 gage staples 7/16" crown	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3" × 0.128"); or 3-16d common (3½" × 0.162"); or 4-3" × 0.131" nails or 4- 3" 14 gage staples 7/16" crown	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1¼" × 20	4-10d box (3" × 0.128"); or 3-10d common (3" × 0.148"); or 4-3" × 0.131"	Face nail each rafter

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
	ga. ridge strap to rafter	nails or 4- 3" 14 gage staples $\frac{7}{16}$ " crown	
6	Rafter or roof truss to plate	<u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> 3-16d box nails ($3\frac{1}{2}$ " x 0.135"); or 3-10d common nails (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4- 3" 14 gage staples $\frac{7}{16}$ " crown	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss'
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2" ridge beam	4-16d ($3\frac{1}{2}$ " x 0.135"); or 3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4- 3" 14 gage staples $\frac{7}{16}$ " crown	Toe nail
		3-16d box $3\frac{1}{2}$ " x 0.135"); or 2-16d common ($3\frac{1}{2}$ " x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 4- 3" 14 gage staples $\frac{7}{16}$ " crown	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common ($3\frac{1}{2}$ " x 0.162")	24" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails; or 4- 3" 14 gage staples $\frac{7}{16}$ " crown	16" o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box ($3\frac{1}{2}$ " x 0.135"); or 3" x 0.131" nails; or 4- 3" 14 gage staples $\frac{7}{16}$ " crown	12" o.c. face nail
		16d common ($3\frac{1}{2}$ " x 0.162")	16" o.c. face nail
10	Built-up header (2" to 2" header with $\frac{1}{2}$ " spacer)	16d common ($3\frac{1}{2}$ " x 0.162")	16" o.c. each edge face nail
		16d box ($3\frac{1}{2}$ " x 0.135")	12" o.c. each edge face nail
11	Continuous header to stud	5-8d box ($2\frac{1}{2}$ " x 0.113"); or 4-8d common ($2\frac{1}{2}$ " x	Toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
		0.131"); or 4-10d box (3" x 0.128")	
12	Top plate to top plate	16d common (3 1/2" x 0.162")	16" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails; or <u>3" 14 gage staples 7/16" crown</u>	12" o.c. face nail
13	Double top plate splice	8-16d common (3 1/2" x 0.162"); or 12-16d box (3 1/2" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails; or <u>12- 3" 14 gage staples 7/16" crown</u>	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2" x 0.162")	16" o.c. face nail
		16d box (3 1/2" x 0.135"); or 3" x 0.131" nails; or <u>3" 14 gage staples 7/16" crown</u>	12" o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails; or <u>4- 3" 14 gage staples 7/16" crown</u>	3 each 16" o.c. face nail 2 each 16" o.c. face nail 4 each 16" o.c. face nail <u>16" o.c. face nail</u>
16	Top or bottom plate to stud	4-8d box (2 1/2" x 0.113"); or 3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or <u>4- 3" 14 gage staples 7/16" crown</u>	Toe nail
		3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or <u>3- 3" 14 gage staples 7/16" crown</u>	End nail
17	Top plates, laps at corners and intersections	3-10d box (3" x 0.128"); or 2-16d common (3 1/2" x 0.162"); or 3-3" x 0.131" nails; or <u>3- 3" 14 gage staples 7/16" crown</u>	Face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
18	1" brace to each stud and plate	<u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> 3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 2-(3" × 0.131"); or 2-10d box (3" × 0.128"); or 2 staples 1½" 2-3" 14 gage staples 7/16" crown	Face nail
19	1" × 6" sheathing to each bearing	<u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> 3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 2-10d box (3" × 0.128"); or 2 staples, 1" crown, 16 ga., 1¾" long	Face nail
20	1" × 8" and wider sheathing to each bearing	<u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> 3-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3 staples, 1" crown, 16 ga., 1¾" long <u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> Wider than 1" × 8" 4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 4 staples, 1" crown, 16 ga., 1¾" long	Face nail
Floor			
21	Joist to sill, top plate or girder	4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3-3" 14 gage staples 7/16" crown	Toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2½" × 0.113")	4" o.c. toe nail
		8d common (2½" × 0.131"); or 10d box (3" × 0.128"); or 3" × 0.131" nails; or 3" 14 gage staples 7/16" crown	6" o.c. toe nail
23	1" × 6" subfloor or less to each joist	<u>Stainless Steel Fasteners Are Not Applicable In This Connection</u> 3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 2 staples, 1" crown, 16 ga., 1¾" long	Face nail
Floor			
24	2" subfloor to joist or girder	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162")	Blind and face nail
25	2" planks (plank & beam—floor & roof)	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162")	At each bearing, face nail
26	Band or rim joist to joist	3-16d common (3½" × 0.162"); or 4-10 box (3" × 0.128"), or 4-3" × 0.131" nails; or 4-3" × 14 ga. staples, 7/16" crown	End nail
27	Built-up girders and beams, 2-inch lumber layers	20d common (4" × 0.192"); or	Nail each layer as follows: 32" o.c. at top and bottom and staggered.
		10d box (3" × 0.128"); or 3" × 0.131" nails; or 3" 14 gage staples 7/16" crown	24" o.c. face nail at top and bottom staggered on opposite sides
		And: 2-20d common (4" × 0.192"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 4-3" 14 gage staples 7/16" crown	Face nail at ends and at each splice
28	Ledger strip supporting joists or rafters	4-16d box (3½" × 0.135"); or 3-16d common (3½" × 0.162"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails; or 3-3" 14 gage staples 7/16" crown	At each joist or rafter, face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION	
29	Bridging or blocking to joist, rafter or truss	2-10d box (3" × 0.128"), or 2-8d common (2½" × 0.131"; or 2-3" × 0.131") nails; or 2-3" 14 gage staples 7/16" crown	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING OF FASTENERS	
			Edges (inches) ^b	Intermediate supports ^c (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
30	3/8" - 1/2"	6d common or deformed (2" × 0.113"); or 23/8" × 0.113" nail (subfloor, wall) 8d common (2½" × 0.131") nail (roof); or RSRS-01 (23/8" × 0.113") nail (roof)	6	12
		8d common (2½" × 0.131") nail (roof); or RSRS-01 (23/8" × 0.113") nail (roof)	6	12'
		23/8" × 0.113" (roof)	4	8
31	19/32" - 4" 3/4"	8d common nail (2½" × 0.131"); or RSRS-01; (23/8" × 0.113") nail (roof)	6	12'
		23/8" × 0.113" (roof)	4	8
		deformed 2" × 0.113" (wall or subfloor)	6	12
32	1-1/8" 7/8" - 1 1/4"	10d common (3" × 0.148") nail; or 8d (2½" × 0.131") deformed nail	6	12
Other wall sheathing^a				
33	1/2" structural cellulosic fiberboard sheathing	1½" × 0.120" galvanized roofing nail, 7/16" head diameter, or 1¼" long 16 ga. staple with 7/16" or 1" crown	3	6
34	25/32" structural cellulosic fiberboard sheathing	1¾" × 0.120" galvanized roofing nail, 7/16" head diameter, or 1½" long 16	3	6

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION	
		ga. staple with $\frac{7}{16}$ " or 1" crown		
35	$\frac{1}{2}$ " gypsum sheathing ^d	$1\frac{1}{2}$ " x 0.120 galvanized roofing nail, $\frac{7}{16}$ " head diameter; or 16 gage staple galvanized, $1\frac{1}{2}$ " long; $\frac{7}{16}$ " or 1" crown or $1\frac{1}{4}$ " screws, Type W or S	7	7
36	$\frac{5}{8}$ " gypsum sheathing ^d	$1\frac{3}{4}$ " x 0.120" galvanized roofing nail; $\frac{7}{16}$ " head diameter; or 16 gage staple galvanized, $1\frac{5}{8}$ " long; $\frac{7}{16}$ " or 1" crown; or $1\frac{5}{8}$ " screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	$\frac{3}{4}$ " and less	deformed (2" x 0.113") or 6d deformed (2" x 0.120") nail; or 8d common ($2\frac{1}{2}$ " x 0.131") nail	6	12
38	$\frac{7}{8}$ " - 1"	8d common ($2\frac{1}{2}$ " x 0.131") nail; or deformed ($2\frac{1}{2}$ " x 0.131"); or 8d-deformed ($2\frac{1}{2}$ " x 0.120") nail	6	12
39	$1\frac{1}{8}$ " - $1\frac{1}{4}$ "	10d common (3" x 0.148") nail; or deformed ($2\frac{1}{2}$ " x 0.131"); or 8d deformed ($2\frac{1}{2}$ " x 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

- a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.
- b. Staples are 16 gage wire and have a minimum $\frac{7}{16}$ -inch on diameter crown width.
- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

- f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.
- g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.
- h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
- i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.
- j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Reason: IRC Table R602.3(1) and IBC Table 2304.10.1 are essentially the same table in terms of structural connections. Although the connections are closely aligned, there are variations in the prescribed fastener in the two tables. Some fasteners are prescribed in the IRC table and not in the IBC table and others are prescribed in the IBC table and not the IRC table. This proposal is written to harmonize the fasteners between the two tables. In addition, where additional information exists in one table and not the other, this too is being harmonized.

For connection # 2,6,18,19, 20 & 23 there was a code change proposal RB272-13 entered in by the American Wood Council for the 2015 IRC. The reference nail values for the nailing schedule were based on Reference Lateral Values and Reference Withdrawal values. All other connections in the table were based on Reference Lateral Design Values. In the 2018 NDS, the reference withdrawal values for stainless steel nails were tabulated in a new NDS table (12.2D). The withdrawal values for stainless steel are lower than the values for carbon steel (bright or galvanized) nails of equivalent diameters.

As such, the lower stainless steel withdrawal values combined with the publication date of the 2018 NDS and the 2015 code proposal date would indicate that the basis of the original code proposal is relevant to only carbon steel nails and not to stainless steel nails. The added note to these connections is to exclude stainless steel from these connections based on the lower withdrawal values.

Connection 1:

Added 14 gage staple from IBC 2304.10.1

Added Blocking Between Rafters or Truss not at the wall top plate to rafter or truss from IBC 2304.10.1

Added flat blocking to truss and web filler from IBC 2304.10.1

Connection 2:

Added note regarding stainless steel fasteners

Added 14 gage staples from IBC 2304.10.1

Connection 3, 5

Added 14 gage staples from IBC 2304.10.1

Connection 6

Added note regarding stainless steel fasteners

Added 14 gage staples from IBC 2304.10.1

Connections 7, 8, 9, 12, 13, 14, 15, 16, 17

Added 14 gage staples from IBC 2304.10.1

Connection 15

Changed fastener spacing and location description to match IBC 2304.10.1

Connection 18

Added note regarding stainless steel fasteners

Added 3" x 0.131" nails from IBC 2304.10.1

Added 14 gage staples from IBC 2304.10.1 and eliminated the 16 gage staple reference

Connections 19 & 20

Added note regarding stainless steel fasteners

Connection 21 & 22

Added 14 gage staples from IBC 2304.10.1

Connection 23

Added note regarding stainless steel fasteners

Connections 27, 28 & 29

Added 14 gage staples from IBC 2304.10.1

Connection 30:

The roof fasteners have been separated from the subfloor and wall fasteners for better clarification when reading

Connection 31:

Panel thickness range is changed to match the thickness range in the IBC.

Connection 32:

Panel thickness range is changed to match the thickness range in the IBC. Additionally, the description **8d** deformed (2½" x 0.131") in an incorrect description. ASTM F1667 does not have a classification for 8d deformed. The correct description is a deformed 2½" x 0.131" nail.

Connections 33 -34

The current nail descriptions are incomplete and missing a shank diameter. These changes match SDPWS

Connection 35-36

The current nail descriptions are incomplete and missing a shank diameter.

Connection 37:

Adding the deformed 2" x 0.113" nail will harmonize with the IBC table. A **6d** deformed 2" x 0.120" nail is not addressed in ASTM F1667. The correct description is a deformed 2" x 0.120" nail and should be used to avoid confusion

Connection 38 & 39:

An **8d** deformed 2½" x 0.120 nail is not addressed in ASTM F1667. The correct description is a deformed 2½" x 0.120 nail and should be used to avoid confusion

Footnote b. deleted because of the addition of the 14 gage staples to the table

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed changes should not change cost of construction as it harmonizes the fasteners between the IBC and IRC

RB193-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:
TABLE R602.3(1)

FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
Roof			

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples 7/16" crown	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2 1/2" x 0.131"); or 2- (3" x 0.131") nails or 2-3" 14 gage staples 7/16" crown	Each end toe nail
		2-16d common (3 1/2" x 0.162"); or 3-(3" x 0.131") nails or 3-3" 14 gage staples 7/16" crown	End nail
	Flat blocking to truss and web filler	16d common (3 1/2" x 0.162"); or (3" x 0.131") nails; or 3" 14 gage staples 7/16" crown	6" o.c. Face nail
2	Ceiling joists to top plate	Stainless Steel Fasteners Are Not Applicable In This Connection 4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples 7/16" crown	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3" x 0.128"); or 3-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails or 4-3" 14 gage staples 7/16" crown	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1 1/4" x 20 ga. ridge strap to rafter	4-10d box (3" x 0.128"); or 3-10d common (3" x 0.148"); or 4-3" x 0.131" nails or 4-3" 14 gage staples 7/16" crown	Face nail each rafter
6	Rafter or roof truss to plate	Stainless Steel Fasteners Are Not Applicable In This Connection 3-16d box nails (3 1/2" x 0.135"); or 3-10d common nails (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples 7/16" crown	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss ¹
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2" ridge beam	4-16d (3 1/2" x 0.135"); or 3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples 7/16" crown	Toe nail
		3-16d box 3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 4-3" 14 gage staples 7/16" crown	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3 1/2" x 0.162")	24" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails; or 4-3" 14 gage staples 7/16" crown	16" o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3 1/2" x 0.135"); or 3" x 0.131" nails; or 4-3" 14 gage staples 7/16" crown	12" o.c. face nail
		16d common (3 1/2" x 0.162")	16" o.c. face nail
10	Built-up header (2" to 2" header with 1/2" spacer)	16d common (3 1/2" x 0.162")	16" o.c. each edge face nail
		16d box (3 1/2" x 0.135")	12" o.c. each edge face nail
11	Continuous header to stud	5-8d box (2 1/2" x 0.113"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128")	Toe nail
12	Top plate to top plate	16d common (3 1/2" x 0.162")	16" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples 7/16" crown	12" o.c. face nail
13	Double top plate splice	8-16d common (3 1/2" x 0.162"); or 12-16d box (3 1/2" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails; or 12-3" 14 gage staples 7/16" crown	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2" x 0.162")	16" o.c. face nail
		16d box (3 1/2" x 0.135"); or 3" x 0.131" nails; or 3" 14 gage staples 7/46" crown	12" o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples 7/46" crown	3 each 16" o.c. face nail 2 each 16" o.c. face nail 4 each 16" o.c. face nail 16" o.c. face nail
16	Top or bottom plate to stud	4-8d box (2 1/2" x 0.113"); or 3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples 7/46" crown	Toe nail
		3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples 7/46" crown	End nail
17	Top plates, laps at corners and intersections	3-10d box (3" x 0.128"); or 2-16d common (3 1/2" x 0.162"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples 7/46" crown	Face nail
18	1" brace to each stud and plate	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-(3" x 0.131"); or 2-10d box (3" x 0.128"); or 2 staples 1 3/4" 2-3" 14 gage staples 7/46" crown	Face nail
19	1" x 6" sheathing to each bearing	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
20	1" x 8" and wider sheathing to each bearing	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
		Stainless Steel Fasteners Are Not Applicable In This Connection Wider than 1" x 8" 4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 4 staples, 1" crown, 16 ga., 1 3/4" long	
Floor			
21	Joist to sill, top plate or girder	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples 7/46" crown	Toe nail
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2 1/2" x 0.113")	4" o.c. toe nail
		8d common (2 1/2" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples 7/46" crown	6" o.c. toe nail
23	1" x 6" subfloor or less to each joist	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
Floor			
24	2" subfloor to joist or girder	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	Blind and face nail
25	2" planks (plank & beam—floor & roof)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	At each bearing, face nail
26	Band or rim joist to joist	3-16d common (3 1/2" x 0.162"); or 4-10 box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" x 14 ga. staples 7/46" crown	End nail
27	Built-up girders and beams, 2-inch lumber layers	20d common (4" x 0.192"); or	Nail each layer as follows: 32" o.c. at top and bottom and staggered.

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION	
		10d box (3" x 0.128"); or 3" x 0.131" nails; or 3" 14 gage staples $\frac{7}{16}$ " crown	24" o.c. face nail at top and bottom staggered on opposite sides	
		And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 4-3" 14 gage staples $\frac{7}{16}$ " crown	Face nail at ends and at each splice	
28	Ledger strip supporting joists or rafters	4-16d box ($3\frac{1}{2}$ " x 0.135"); or 3-16d common ($3\frac{1}{2}$ " x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 3-3" 14 gage staples $\frac{7}{16}$ " crown	At each joist or rafter, face nail	
29	Bridging or blocking to joist, rafter or truss	2-10d box (3" x 0.128"); or 2-8d common ($2\frac{1}{2}$ " x 0.131"); or 2-3" x 0.131" nails; or 2-3" 14 gage staples $\frac{7}{16}$ " crown	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING OF FASTENERS	
			Edges (inches) ^h	Intermediate supports ^e (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
30	$3\frac{3}{8}$ " - $1\frac{1}{2}$ "	6d common or deformed (2 " x 0.113" x 0.266" head); or $2\frac{3}{8}$ " x 0.113" x 0.266" head nail (subfloor, wall) ⁱ ; 8d common ($2\frac{1}{2}$ " x 0.131") nail (roof); or RSRS-01 ($2\frac{3}{8}$ " x 0.113") nail (roof) ^j	6	12
		8d common ($2\frac{1}{2}$ " x 0.131") nail (roof); or RSRS-01 ($2\frac{3}{8}$ " x 0.113") nail (roof) ^j	6	12 ^f
		$2\frac{3}{8}$ " x 0.113" (roof)	4	8
31	$1\frac{9}{32}$ " - 1 " $3\frac{3}{4}$ "	8d common nail ($2\frac{1}{2}$ " x 0.131"); or RSRS-01; ($2\frac{3}{8}$ " x 0.113") nail (roof) ^j	6	12 ^f
		$2\frac{3}{8}$ " x 0.113" (roof)	4	8
		deformed 2" x 0.113" x 0.266" head (wall or subfloor)	6	12
32	$1\frac{1}{8}$ " $7\frac{7}{8}$ " - $1\frac{1}{4}$ "	10d common (3" x 0.148") nail; or 8d ($2\frac{1}{2}$ " x 0.131" x 0.281" head) deformed nail	6	12
Other wall sheathing^g				
33	$\frac{1}{2}$ " structural cellulosic fiberboard sheathing	$1\frac{1}{2}$ " x 0.120" galvanized roofing nail, $\frac{7}{16}$ " head diameter, or $1\frac{1}{4}$ " long 16 ga. staple with $\frac{7}{16}$ " or 1" crown	3	6
34	$\frac{25}{32}$ " structural cellulosic fiberboard sheathing	$1\frac{3}{4}$ " x 0.120" galvanized roofing nail, $\frac{7}{16}$ " head diameter, or $1\frac{1}{2}$ " long 16 ga. staple with $\frac{7}{16}$ " or 1" crown	3	6
35	$\frac{1}{2}$ " gypsum sheathing ^d	$1\frac{1}{2}$ " x 0.120 galvanized roofing nail, $\frac{7}{16}$ " head diameter; or 16 gage staple galvanized, $1\frac{1}{2}$ " long; $\frac{7}{16}$ " or 1" crown or $1\frac{1}{4}$ " screws, Type W or S	7	7
36	$\frac{5}{8}$ " gypsum sheathing ^d	$1\frac{3}{4}$ " x 0.120" galvanized roofing nail; $\frac{7}{16}$ " head diameter; or 16 gage staple galvanized, $1\frac{5}{8}$ " long; $\frac{7}{16}$ " or 1" crown; or $1\frac{5}{8}$ " screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	$\frac{3}{4}$ " and less	deformed (2 " x 0.113") or 6d deformed (2 " x 0.120") nail; or 8d common ($2\frac{1}{2}$ " x 0.131") nail	6	12
38	$\frac{7}{8}$ " - 1 "	8d common ($2\frac{1}{2}$ " x 0.131") nail; or deformed ($2\frac{1}{2}$ " x 0.131"); or 8d deformed ($2\frac{1}{2}$ " x 0.120") nail	6	12
39	$1\frac{1}{8}$ " - $1\frac{1}{4}$ "	10d common (3" x 0.148") nail; or deformed ($2\frac{1}{2}$ " x 0.131"); or 8d deformed ($2\frac{1}{2}$ " x 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.

- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
- f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.
- g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.
- h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
- i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.
- j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Committee Reason: The modification removes staples since they are not equivalent. Also the prohibition of stainless steel nails was removed - this is needed in coastal areas where there is exposure to salt spray. Stainless steel fasteners can be evaluated as equivalent. The main change will coordinate the IRC and IBC tables. The proposal with the modification will allow for different construction options. (Vote: 9-2)

Assembly Action: **None**

RB193-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R602.3(1) (New)

Proponents:

Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

**TABLE R602.3(1)
FASTENING SCHEDULE**

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
Roof			
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2 1/2" x 0.131"); or 2- (3" x 0.131") nails	Each end toe nail
		2-16d common (3 1/2" x 0.162"); or 3-(3" x 0.131") nails	End nail
	Flat blocking to truss and web filler	16d common (3 1/2" x 0.162"); or (3" x 0.131") nails;	6" o.c. Face nail
2	Ceiling joists to top plate	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3" x 0.128"); or 3-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1 1/4" x 20 ga. ridge strap to rafter	4-10d box (3" x 0.128"); or 3-10d common (3" x 0.148"); or 4-3" x 0.131" nails	Face nail each rafter
6	Rafter or roof truss to plate	S 3-16d box nails (3 1/2" x 0.135"); or 3-10d common nails (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss ⁱ
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2" ridge beam	4-16d (3 1/2" x 0.135"); or 3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	Toe nail
		3-16d box 3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3 1/2" x 0.162")	24" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails	16" o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3 1/2" x 0.135"); or 3" x 0.131" nails	12" o.c. face nail
		16d common (3 1/2" x 0.162")	16" o.c. face nail
10	Built-up header (2" to 2" header with 1/2" spacer)	16d common (3 1/2" x 0.162")	16" o.c. each edge face nail
		16d box (3 1/2" x 0.135")	12" o.c. each edge face nail
11	Continuous header to stud	5-8d box (2 1/2" x 0.113"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128")	Toe nail
12	Top plate to top plate	16d common (3 1/2" x 0.162")	16" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails	12" o.c. face nail
13	Double top plate splice	8-16d common (3 1/2" x 0.162"); or 12-16d box (3 1/2" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2" x 0.162")	16" o.c. face nail
		16d box (3 1/2" x 0.135"); or 3" x 0.131" nails	12" o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails	3 each 16" o.c. face nail 2 each 16" o.c. face nail 4 each 16" o.c. face nail 16" o.c. face nail
		4-8d box (2 1/2" x 0.113"); or 3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	Toe nail

16	Top or bottom plate to stud	0.131" nails	End nail	
		3-16d box (3 ¹ / ₂ " x 0.135"); or 2-16d common (3 ¹ / ₂ " x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails		
17	Top plates, laps at corners and intersections	3-10d box (3" x 0.128"); or 2-16d common (3 ¹ / ₂ " x 0.162"); or 3-3" x 0.131" nails	Face nail	
18	1" brace to each stud and plate	3-8d box (2 ¹ / ₂ " x 0.113"); or 2-8d common (2 ¹ / ₂ " x 0.131"); or 2-(3" x 0.131"); or 2-10d box (3" x 0.128")	Face nail	
19	1" x 6" sheathing to each bearing	3-8d box (2 ¹ / ₂ " x 0.113"); or 2-8d common (2 ¹ / ₂ " x 0.131"); or 2-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 ³ / ₄ " long	Face nail	
20	1" x 8" and wider sheathing to each bearing	3-8d box (2 ¹ / ₂ " x 0.113"); or 3-8d common (2 ¹ / ₂ " x 0.131"); or 3-10d box (3" x 0.128"); or 3 staples, 1" crown, 16 ga., 1 ³ / ₄ " long	Face nail	
		Wider than 1" x 8" 4-8d box (2 ¹ / ₂ " x 0.113"); or 3-8d common (2 ¹ / ₂ " x 0.131"); or 3-10d box (3" x 0.128"); or 4 staples, 1" crown, 16 ga., 1 ³ / ₄ " long		
Floor				
21	Joist to sill, top plate or girder	4-8d box (2 ¹ / ₂ " x 0.113"); or 3-8d common (2 ¹ / ₂ " x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails;	Toe nail	
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2 ¹ / ₂ " x 0.113")	4" o.c. toe nail	
		8d common (2 ¹ / ₂ " x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	6" o.c. toe nail	
23	1" x 6" subfloor or less to each joist	3-8d box (2 ¹ / ₂ " x 0.113"); or 2-8d common (2 ¹ / ₂ " x 0.131"); or 3-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 ³ / ₄ " long	Face nail	
Floor				
24	2" subfloor to joist or girder	3-16d box (3 ¹ / ₂ " x 0.135"); or 2-16d common (3 ¹ / ₂ " x 0.162")	Blind and face nail	
25	2" planks (plank & beam—floor & roof)	3-16d box (3 ¹ / ₂ " x 0.135"); or 2-16d common (3 ¹ / ₂ " x 0.162")	At each bearing, face nail	
26	Band or rim joist to joist	3-16d common (3 ¹ / ₂ " x 0.162"); or 4-10 box (3" x 0.128"), or 4-3" x 0.131" nails	End nail	
27	Built-up girders and beams, 2-inch lumber layers	20d common (4" x 0.192"); or	Nail each layer as follows: 32" o.c. at top and bottom and staggered.	
		10d box (3" x 0.128"); or 3" x 0.131" nails	24" o.c. face nail at top and bottom staggered on opposite sides	
		And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Face nail at ends and at each splice	
28	Ledger strip supporting joists or rafters	4-16d box (3 ¹ / ₂ " x 0.135"); or 3-16d common (3 ¹ / ₂ " x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	At each joist or rafter, face nail	
29	Bridging or blocking to joist, rafter or truss	2-10d box (3" x 0.128"), or 2-8d common (2 ¹ / ₂ " x 0.131"); or 2-3" x 0.131" nails	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING OF FASTENERS	
			Edges (inches) ^h	Intermediate supports ^e : (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
30	3/8" - 1/2"	6d common or deformed (2" x 0.113" x 0.266" head); or 2 ³ / ₈ " x 0.113" x 0.266" head nail (subfloor, wall); 8d common (2 ¹ / ₂ " x 0.131") nail (roof); or RSRS-01 (2 ³ / ₈ " x 0.113") nail (roof) ^j	6	12
		8d common (2 ¹ / ₂ " x 0.131") nail (roof); or RSRS-01 (2 ³ / ₈ " x 0.113") nail (roof) ^j	6	12 ^f

31	1 ⁹ / ₃₂ " – 1" 3/4"	8d common nail (2 ¹ / ₂ " x 0.131"); or RSRS-01; (2 ³ / ₈ " x 0.113") nail (roof) ^l	6	12 ^f
		deformed 2" x 0.113" x 0.266" head (wall or subfloor)	6	12
32	1 ¹ / ₈ " 7/8" – 1 ¹ / ₄ "	10d common (3" x 0.148") nail; or 8d (2 ¹ / ₂ " x 0.131" x 0.281" head) deformed nail	6	12
Other wall sheathing^g				
33	1/2" structural cellulosic fiberboard sheathing	1 ¹ / ₂ " x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 ¹ / ₄ " long 16 ga. staple with 7/16" or 1" crown	3	6
34	25/32" structural cellulosic fiberboard sheathing	1 ³ / ₄ " x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 ¹ / ₂ " long 16 ga. staple with 7/16" or 1" crown	3	6
35	1/2" gypsum sheathing ^d	1 ¹ / ₂ " x 0.120 galvanized roofing nail, 7/16" head diameter; or 16 gage staple galvanized, 1 ¹ / ₂ " long; 7/16" or 1" crown or 1 ¹ / ₄ " screws, Type W or S	7	7
36	5/8" gypsum sheathing ^d	1 ³ / ₄ " x 0.120" galvanized roofing nail; 7/16" head diameter; or 16 gage staple galvanized, 1 ⁵ / ₈ " long; 7/16" or 1" crown; or 1 ⁵ / ₈ " screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	3/4" and less	deformed (2" x 0.113") or 6d deformed (2" x 0.120") nail; or 8d common (2 ¹ / ₂ " x 0.131") nail	6	12
38	7/8" – 1"	8d common (2 ¹ / ₂ " x 0.131") nail; or deformed (2 ¹ / ₂ " x 0.131"); or 8d deformed (2 ¹ / ₂ " x 0.120") nail	6	12
39	1 ¹ / ₈ " – 1 ¹ / ₄ "	10d common (3" x 0.148") nail; or deformed (2 ¹ / ₂ " x 0.131"); or 8d deformed (2 ¹ / ₂ " x 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

- a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials or dimensions, such as stainless steel, shall be designed by accepted engineering practice or approved under Section R104.11.
- b. Staples are 16 gage wire and have a minimum
- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
- f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.
- g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.
- h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
- i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.
- j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Commenter's Reason: This public comment adds language to new footnote a in order to further clarify that the code change proposal, as approved at the CAH, deletes stainless steel nails and staples from this table. The added language is proposed because it is feared that users of the code will easily miss this change, and not necessarily understand that stainless steel is not carbon steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Since stainless steel is being deleted in the approval in the CAH, this comment only provides clarification and does not add any cost effects to what is already accepted.

Public Comment# 1947

Public Comment 2:

IRC@: TABLE R602.3(1) (New)

Proponents:

J Daniel Dolan, representing Federal Emergency Management Agency/ Applied Technology Council Seismic Codes Support Committee
(jddolan@wsu.edu)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

**TABLE R602.3(1)
FASTENING SCHEDULE**

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
Roof			
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2 1/2" x 0.131"); or 2- (3" x 0.131") nails	Each end toe nail
		2-16d common (3 1/2" x 0.162"); or 3-(3" x 0.131") nails	End nail
	Flat blocking to truss and web filler	16d common (3 1/2" x 0.162"); or (3" x 0.131") nails;	6" o.c. Face nail
2	Ceiling joists to top plate	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3" x 0.128"); or 3-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1 1/4" x 20 ga. ridge strap to rafter	4-10d box (3" x 0.128"); or 3-10d common (3" x 0.148"); or 4-3" x 0.131" nails	Face nail each rafter
6	Rafter or roof truss to plate	S 3-16d box nails (3 1/2" x 0.135"); or 3-10d common nails (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss ⁱ
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2" ridge beam	4-16d (3 1/2" x 0.135"); or 3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	Toe nail
		3-16d box 3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3 1/2" x 0.162")	24" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails	16" o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3 1/2" x 0.135"); or 3" x 0.131" nails	12" o.c. face nail
		16d common (3 1/2" x 0.162")	16" o.c. face nail
10	Built-up header (2" to 2" header with 1/2" spacer)	16d common (3 1/2" x 0.162")	16" o.c. each edge face nail
		16d box (3 1/2" x 0.135")	12" o.c. each edge face nail
11	Continuous header to stud	5-8d box (2 1/2" x 0.113"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128")	Toe nail
12	Top plate to top plate	16d common (3 1/2" x 0.162")	16" o.c. face nail
		10d box (3" x 0.128"); or 3" x 0.131" nails	12" o.c. face nail
13	Double top plate splice	8-16d common (3 1/2" x 0.162"); or 12-16d box (3 1/2" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 1/2" x 0.162")	16" o.c. face nail
		16d box (3 1/2" x 0.135"); or 3" x 0.131" nails	12" o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 4-3" x 0.131" nails	3 each 16" o.c. face nail 2 each 16" o.c. face nail 4 each 16" o.c. face nail 16" o.c. face nail
		4-8d box (2 1/2" x 0.113"); or 3-16d box (3 1/2" x 0.135"); or 4-8d common (2 1/2" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	Toe nail

16	Top or bottom plate to stud	0.131" nails	End nail	
		3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails		
17	Top plates, laps at corners and intersections	3-10d box (3" x 0.128"); or 2-16d common (3 1/2" x 0.162"); or 3-3" x 0.131" nails	Face nail	
18	1" brace to each stud and plate	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-(3" x 0.131"); or 2-10d box (3" x 0.128")	Face nail	
19	1" x 6" sheathing to each bearing	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 2-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail	
20	1" x 8" and wider sheathing to each bearing	3-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3 staples, 1" crown, 16 ga., 1 3/4" long	Face nail	
		Wider than 1" x 8" 4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 4 staples, 1" crown, 16 ga., 1 3/4" long		
Floor				
21	Joist to sill, top plate or girder	4-8d box (2 1/2" x 0.113"); or 3-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails;	Toe nail	
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2 1/2" x 0.113")	4" o.c. toe nail	
		8d common (2 1/2" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	6" o.c. toe nail	
23	1" x 6" subfloor or less to each joist	3-8d box (2 1/2" x 0.113"); or 2-8d common (2 1/2" x 0.131"); or 3-10d box (3" x 0.128"); or 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail	
Floor				
24	2" subfloor to joist or girder	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	Blind and face nail	
25	2" planks (plank & beam—floor & roof)	3-16d box (3 1/2" x 0.135"); or 2-16d common (3 1/2" x 0.162")	At each bearing, face nail	
26	Band or rim joist to joist	3-16d common (3 1/2" x 0.162"); or 4-10 box (3" x 0.128"), or 4-3" x 0.131" nails	End nail	
27	Built-up girders and beams, 2-inch lumber layers	20d common (4" x 0.192"); or	Nail each layer as follows: 32" o.c. at top and bottom and staggered.	
		10d box (3" x 0.128"); or 3" x 0.131" nails	24" o.c. face nail at top and bottom staggered on opposite sides	
		And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Face nail at ends and at each splice	
28	Ledger strip supporting joists or rafters	4-16d box (3 1/2" x 0.135"); or 3-16d common (3 1/2" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	At each joist or rafter, face nail	
29	Bridging or blocking to joist, rafter or truss	2-10d box (3" x 0.128"), or 2-8d common (2 1/2" x 0.131"); or 2-3" x 0.131" nails	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING OF FASTENERS	
			Edges (inches) ^h	Intermediate supports ^e : (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
30	3/8" - 1/2"	6d common or deformed (2" x 0.113" x 0.266" head); or 2 3/8" x 0.113" x 0.266" head nail (subfloor, wall); 8d common (2 1/2" x 0.131") nail (roof); or RSRs-01 (2 3/8" x 0.113") nail (roof) ^j	6	12
		8d common (2 1/2" x 0.131") nail (roof); or RSRs-01 (2 3/8" x 0.113") nail (roof) ^j	6	12 ^f

31	1 ⁹ / ₃₂ " – 1" 3/4"	8d common nail (2 ¹ / ₂ " x 0.131"); or RSRS-01; (2 ³ / ₈ " x 0.113") nail (roof) ^l	6	12 ^f
		deformed 2" x 0.113" x 0.266" head (wall or subfloor)	6	12
32	1 ¹ / ₈ " 7/8" – 1 ¹ / ₄ "	10d common (3" x 0.148") nail; or 8d (2 ¹ / ₂ " x 0.131" x 0.281" head) deformed nail	6	12
Other wall sheathing^g				
33	1/2" structural cellulosic fiberboard sheathing	1 ¹ / ₂ " x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 ¹ / ₄ " long 16 ga. staple with 7/16" or 1" crown	3	6
34	25/32" structural cellulosic fiberboard sheathing	1 ³ / ₄ " x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 ¹ / ₂ " long 16 ga. staple with 7/16" or 1" crown	3	6
35	1/2" gypsum sheathing ^d	1 ¹ / ₂ " x 0.120 galvanized roofing nail, 7/16" head diameter; or 16 gage staple galvanized, 1 ¹ / ₂ " long; 7/16" or 1" crown or 1 ¹ / ₄ " screws, Type W or S	7	7
36	5/8" gypsum sheathing ^d	1 ³ / ₄ " x 0.120" galvanized roofing nail; 7/16" head diameter; or 16 gage staple galvanized, 1 ⁵ / ₈ " long; 7/16" or 1" crown; or 1 ⁵ / ₈ " screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	3/4" and less	deformed (2" x 0.113") or 6d deformed (2" x 0.120") nail; or 8d common (2 ¹ / ₂ " x 0.131") nail	6	12
38	7/8" – 1"	8d common (2 ¹ / ₂ " x 0.131") nail; or deformed (2 ¹ / ₂ " x 0.131"); or 8d deformed (2 ¹ / ₂ " x 0.120") nail	6	12
39	1 ¹ / ₈ " – 1 ¹ / ₄ "	10d common (3" x 0.148") nail; or deformed (2 ¹ / ₂ " x 0.131"); or 8d deformed (2 ¹ / ₂ " x 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

- a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials, such as stainless steel, shall be designed by accepted engineering practice or approved under Section R104.11.
- b. Staples are 16 gage wire and have a minimum
- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
- f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.
- g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.
- h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
- i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.
- j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Commenter's Reason: This public comment adds language to footnote a in order to clarify that the table pertains to carbon steel fasteners and connections and clarifies that the code change, as approved by the CAH, deletes stainless steel nails and staples from the table. The added language is proposed because if is feared that users of the code will easily miss this change, and not necessarily understand that stainless steel (or

other materials) may not perform the same as carbon steel. These other materials may require differences in design to achieve equivalent performance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed comment does not add additional requirements, but rather clarifies that stainless steel (and other materials) required different considerations due to the differences in strength and withdrawal characteristics. Since stainless steel is being deleted in the approval in the CAH, this comment only provides clarification and does not add any cost effects to what is already accepted.

Public Comment# 2135

RB203-19

IRC@: TABLE R602.10.3(3)

Proposed Change as Submitted

Proponents: Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

2018 International Residential Code

Revise as follows:

**TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY**

Portions of table not shown remain unchanged.

• SOIL CLASS D ^b • WALL HEIGHT = 10 FEET• 10 PSF FLOOR DEAD LOAD• 15 PSF ROOF/CEILING DEAD LOAD• BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, f}				
Seismic Design Category	Story Location	Braced Wall Line Length (feet) ^c	Method LIB ^d	Method GB	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB ^e	Methods WSP, PFH, PFG ^e , and ABW	Methods CS-WSP, CS-G, CS-PF

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

- a. Linear interpolation shall be permitted.
- b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the seismic design categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.2 of the International Building Code.
- c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.
- d. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.
- e. Methods PFG and CS-SFB do not apply in Seismic Design Categories D0, D₁ and D₂.
- f. Where more than one bracing method is used, mixing methods shall be in accordance with Section R602.10.4.1.

Reason:

Last cycle, the tables for Bracing Requirements Based on Wind Speed and Bracing Requirements Based on Seismic Design Category were revised so that they included all the permissible bracing methods. For some reason, three permissible bracing methods were left off of Table R602.10.3(3). So we are proposing to add methods ABW, PFH, and PFG in to the table in the WSP column heading. ABW, PFH, and PFG are intermittent bracing methods that have amounts of bracing based on their equivalency to a WSP braced wall panel. Note that Method PFG is only permitted in Seismic Design Categories A, B, and C per Section R602.10.6, but footnote e already reflects that. so the only action needed is to add the reference to footnote e. This method has to be listed because there are also requirements for Townhouses in SDC C in this table.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal is meant to only clarify that Braced Wall Panel methods ABW, PFH, and PFG are permitted to be used in SDC C townhomes and that ABW and PFH are permitted to be used in Seismic Design Categories D0, D1, and D2. If anything, there could be a decrease in cost if builders were able to use a more economical method because of this clarification.

RB203-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The proposal will increase bracing method options. The limitations of the PFG limitations are addressed in footnote e. (Vote: 10-0)

Assembly Action:

None

RB203-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R602.10.3(3)

Proponents:

Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY**

• SOIL CLASS D ^b • WALL HEIGHT = 10 FEET• 10 PSF FLOOR DEAD LOAD• 15 PSF ROOF/CEILING DEAD LOAD• BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, f, g}				
Seismic Design Category	Story Location	Braced Wall Line Length (feet) ^c	Method LIB ^d	Method GB	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB ^e	Methods WSP, PFH ^f , PFG ^{e, f} , and ABW ^f	Methods CS-WSP, CS-G, CS-PF

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

- a. Linear interpolation shall be permitted.
- b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the seismic design categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.2 of the International Building Code.
- c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.
- d. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.
- e. Methods PFG and CS-SFB do not apply in Seismic Design Categories D0, D₁ and D₂.
- f. Methods PFH, PFG and ABW are only permitted on a single story or a first of two stories.
- f. g. Where more than one bracing method is used, mixing methods shall be in accordance with Section R602.10.4.1.

Commenter's Reason: This Public Comment proposes further modification of a Proposal that was approved at the Committee Action Hearings. The original proposal added three bracing methods, PFH, PFG, and ABW, to the heading of the seismic bracing length table. This Public Comments seeks to add a footnote to describe the limitations that are placed on the locations of these bracing methods. All these bracing methods are only permitted on one story buildings or on the first of two-story buildings. However, this table has other entries, including first of three-story buildings, that are not permitted for these bracing methods. In order to avoid the confusion of a possible code conflict, it is proposed to add these limitations as a footnote to this table to make sure it is understood that not all the rows in the table will be applicable to this method. This also will reinforce these limitations because they are only explicitly stated in the description of the specific bracing method for one of the three methods. For current (2018 IRC) limitations of Method PFH, see Table R602.10.5. For current limitations of Method ABW, see Table R602.10.6.1. For current limitations of Method PFG, see text in Section R602.10.6.3.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This Public Comment has no cost impact. It is just editorially clarifying requirements for where the methods may be installed. There is no intent to change code requirements.

RB212-19 Part I

IRC: R602.13 (New)

Proposed Change as Submitted

Proponents: Vladimir Kochkin, Home Innovation Research Labs, representing Home Innovation Research Labs (vkochkin@homeinnovation.com); Patricia Gunderson, Home Innovation Research Labs, representing Home Innovation Research Labs (pgunderson@homeinnovation.com)

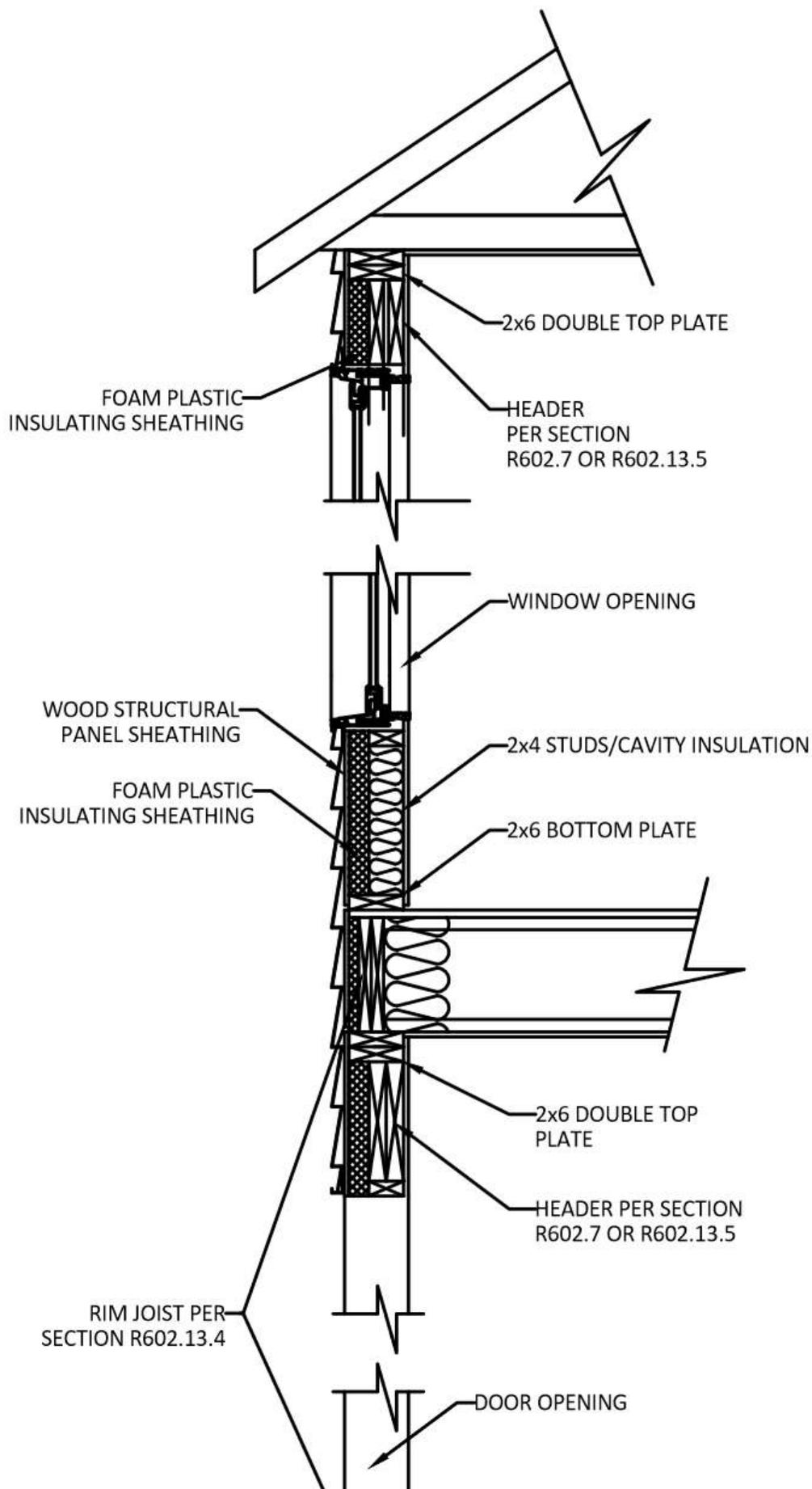
THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IRC-BUILDING COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Residential Code

Add new text as follows:

R602.13 Extended Plate Wall. Extended plate wall (EPW) construction shall comply with all applicable provisions of Sections R602.1 through R602.12 as modified by the provisions of Section R602.13. EPW shall be limited to Seismic Design Categories A, B, and C for detached one- and two-family dwellings and to Seismic Design Categories A and B for townhomes.

R602.13.1 Framing. The 2x6 top and bottom plates and 2x4 studs shall be used in accordance with Figures R602.13.1(1) and R602.13.1(2). A single top plate shall not be permitted.



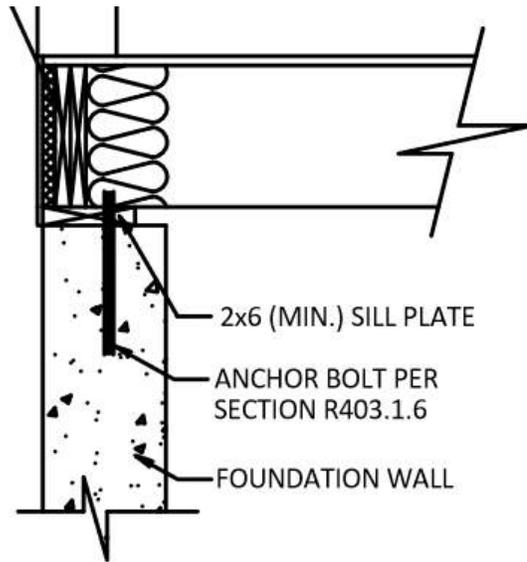


Figure R602.13.1(1)
Extended Plate Wall (EPW) System, Section View

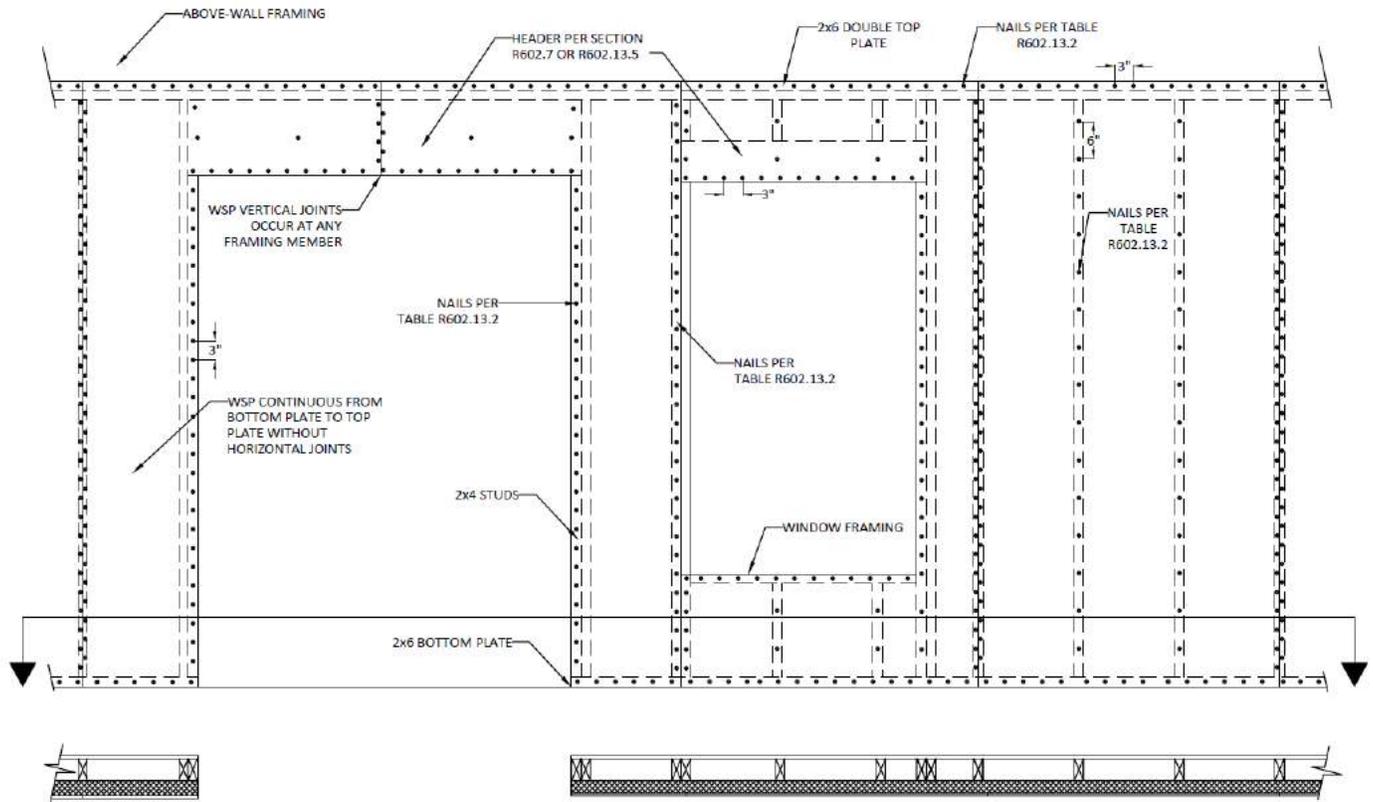


Figure R602.13.1(2)
Extended Plate Wall, Elevation View

R602.13.2 Wood structural panel sheathing. Wood structural panel sheathing with a minimum nominal thickness of 7/16-inch (11 mm) shall be installed vertically and attached to wall plates and studs per Table R602.13.2 and Figure R602.13.1(2). The vertical joints between adjacent wood structural panels shall occur only at framing members. Where used as part of wall bracing, each wood structural panel shall be continuous, without horizontal joints between the extended top and bottom plates.

**TABLE R602.13.2.
Sheathing Fastener Requirements for EPW**

Minimum Nail Length and Diameter	Maximum Fastener Spacing	
	At Perimeter of Wood Structural Panels (inches)	In Field of Wood Structural Panels (inches)
No. 37 Power-tool Driven Common Nail (3-1/2" x 0.131") ^{a,b,c,d}	3 O.C.	6 O.C.
16d Box Nail (3-1/2" x 0.135") ^{a,b,d}	3 O.C.	6 O.C.

For SI: 1-inch = 25.4 mm

- a. Where wood structural panel nominal thickness exceeds 1/2 inch (13 mm), the minimum nail length shall be increased by 1/4 inch (6 mm).
- b. At top and bottom plates where the wood structural panel is in direct contact with the framing, 8d common nail (2-1/2" x 0.131") shall be permitted.
- c. Full round head nail with minimum head diameter of 0.281 inches (7 mm).
- d. Nails are in accordance with ASTM F1667.

R602.13.3 Wall bracing. Wall bracing for EPW shall be in accordance with the requirements for WSP or CS-WSP or CS-G bracing methods in Section R602.10 except the sheathing fasteners shall be in accordance with Table R602.13.2.

R602.13.3.1 Simplified wall bracing. With the exception of Section R602.12.2 Item 2, provisions of Section R602.12 shall be applicable to the EPW. The fastening schedule for wood structural panels shall be in accordance with Table R602.13.2.

R602.13.4 Rim joist. Sawn 2x lumber or engineered wood rim board shall be used to construct rim joists. Engineered wood rim board shall be in compliance with Section R602.1.7. The minimum bearing length requirements for the floor joists shall be satisfied or joists shall be supported with metal hangers. Rim joist (band joist) supporting an EPW shall be in accordance with one of the following methods.

1. A double member rim joist installed flush to the exterior face of the wall in accordance with Figure R602.13.4(1). The thickness of individual rim joist members shall not be less than 1-1/2 inches (38 mm).
2. A double member rim joist recessed by 1 inch (25 mm) from the exterior face of the wall in accordance with Figure R602.13.4(2). The thickness of individual rim joist members shall not be less than 1 inch (25 mm). Foam plastic insulative sheathing shall be installed in the 1 inch (25 mm) recess.
3. Approved engineered design.

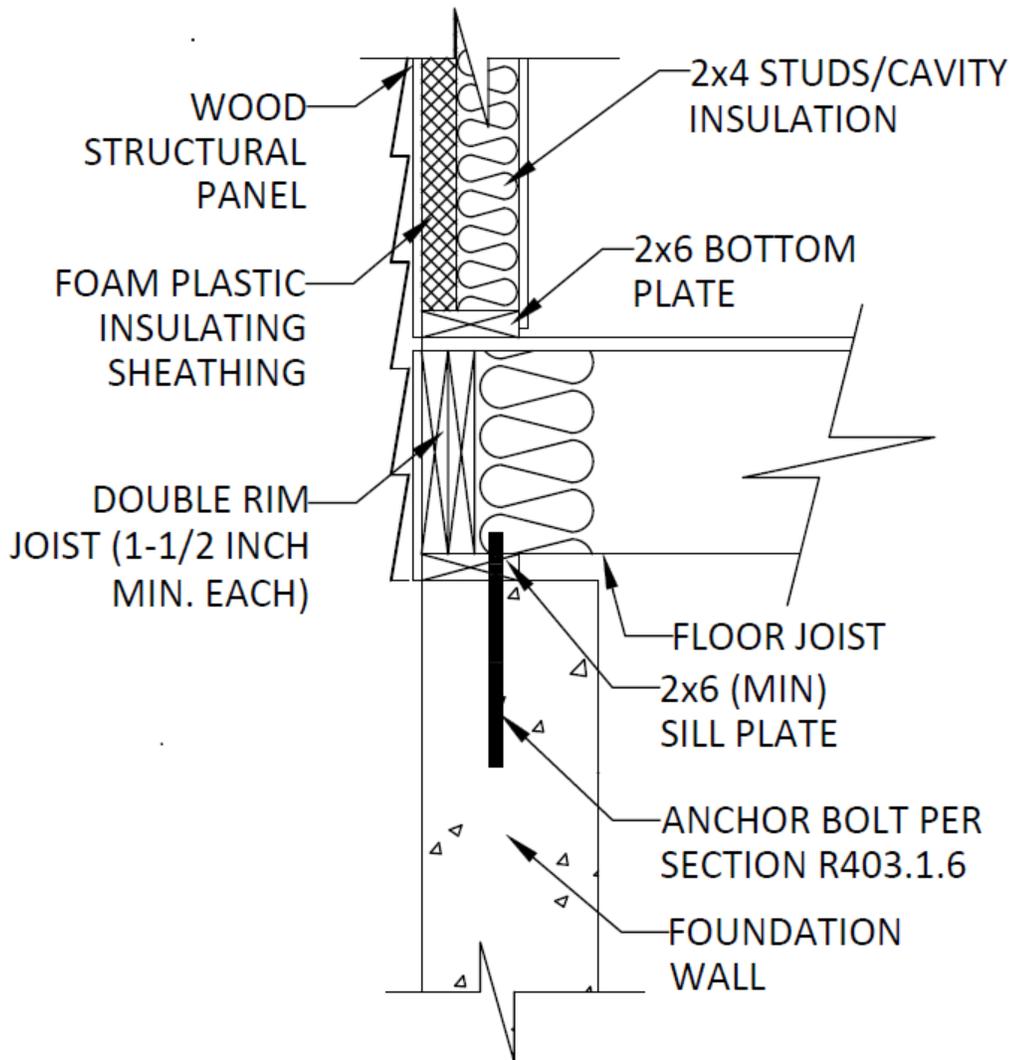


Figure R602.13.4(1)
Rim Joist Construction for EPW – Double Member

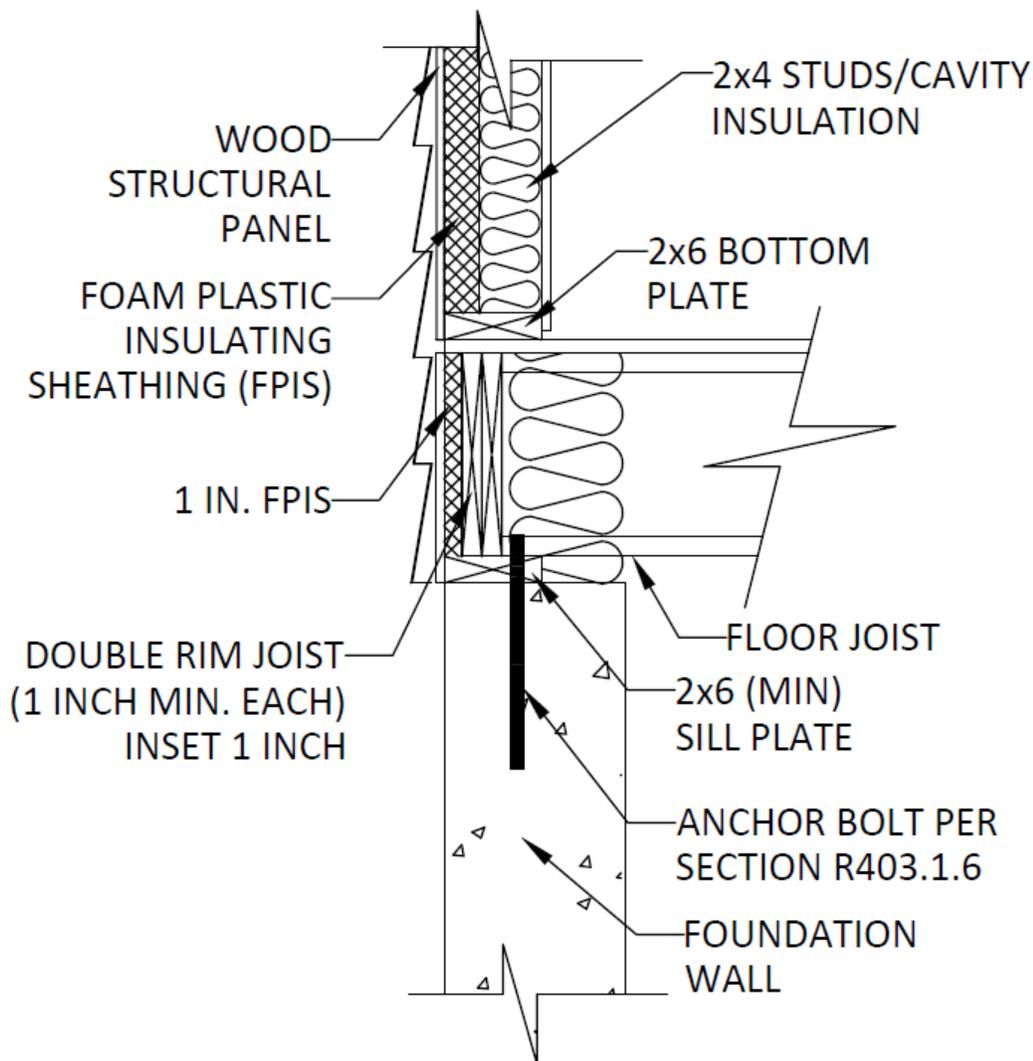


Figure R602.13.4(2)
Rim Joist Construction for EPW – Inset Double Member

R602.13.5 Rim joist used as rim header. Wood rim boards, or band joists, that serve as rim board headers shall be constructed in accordance with Section R602.7.2.

R602.13.6 Foam plastic insulating sheathing. Foam plastic insulating sheathing (FPIS) with a total thickness of 2 inches (51 mm) shall be installed between top and bottom plates directly to the exterior surface of studs and flush with the 2x6 top and bottom plates. FPIS shall comply with ASTM C578 or ASTM C1289, with a minimum compressive strength of 15 psi. FPIS shall be permitted to be installed in one or more layers.

R602.13.7 Wall coverings. Interior and exterior coverings and wall finishes shall be in accordance with all applicable provisions of Sections R701 through R703 as modified by the provisions of Sections R602.13.7.1 and R602.13.7.2.

R602.13.7.1 Vapor retarder. A vapor retarder on the interior side of the EPW frame shall be in accordance with Section R702.7. Where a Class III interior vapor retarder is used in accordance with Table R702.7.1, EPW shall be designated as a 2x4 wall with continuous insulation and, in Climate Zones 4, 5, 6, 7, and 8, the foam plastic insulating sheathing layer including any facers or surface film shall have a water vapor permeance of less than or equal to 1.5 perms.

R602.13.7.2 Cladding attachment. Cladding shall be specified and installed in accordance with Section R703 and one of the following:

1. Table R703.3.3 for siding attachment to wood structural panels only.
2. Table R703.8.4(2) for brick tie-spacing and attachment to wood structural panels only.
3. Fastening schedule and fasteners as required by Table R703.3.(1), except fastener length shall be selected to meet or exceed the minimum required penetration into framing.

R602.13.8 Uplift connections. Where roof uplift tie-downs are selected in accordance with Section R802.11, the roof tie-downs shall be fastened to either side of the double top plate or, if required to be fastened to studs, shall be installed from the interior face of the wall in accordance with manufacturer's installation instructions. Where uplift forces determined in accordance with R602.3.5 require approved uplift connectors between

floors or between foundation and the floor, these uplift connectors shall not rely on wood structural panel sheathing for resisting roof wind uplift forces.

Reason: The Extended Plate Wall (EPW) provides a compliance option for meeting energy code requirements for above-grade walls. In addition, it provides a construction option for many above-code energy efficiency and green programs. EPW represents a method of construction that uses standard framing, sheathing, fastening, and insulating materials configured for optimized constructability and performance. EPW preserves many traditional construction practices while achieving better levels of energy performance. The system has been extensively evaluated over the course of 5 years for its structural performance, moisture performance, energy performance, and constructability in the field. The evaluations have been funded by the USDA's Forest Products Laboratory, U.S. Department of Energy, New York State Energy Research and Development Authority, and American Chemistry Council. Four demonstration homes have been constructed and are now occupied. The wall system can be assembled in the field or fabricated in a factory for on-site installation. Results of evaluations and structural testing, background information, and design and construction guidance are available at www.homeinnovation.com/EPW. Based on the scope of the evaluations, the proposed system is limited to low-seismic and low-wind areas.

Bibliography: www.homeinnovation.com/EPW

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal adds a new optional solution for achieving compliance with current energy code provisions.

RB212-19 Part I

Public Hearing Results

Errata: This proposal includes published errata. Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The committee has several concerns with the proposal as follows: foam is not structural; this needs to be an engineered system; there are concerns for uplift; point loads from roof trusses could be detrimental to the plate wall; the proposal is not clear for the nailing between the 1st and 2nd floor. (Vote: 10-1)

Assembly Action:

None

RB212-19 Part I

Individual Consideration Agenda

Public Comment 1:

IRC@: R602.13 (New)

Proponents:

Vladimir Kochkin, representing Home Innovation Research Labs (vkochkin@homeinnovation.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R602.13 Extended Plate Wall. Extended plate wall (EPW) construction shall comply with ~~all applicable~~ the provisions of Sections R602.1 through R602.12 except as modified by the provisions of Section R602.13. EPW shall be limited to Seismic Design Categories A, B, and C for detached one- and two-family dwellings and to Seismic Design Categories A and B for townhomes.

Commenter's Reason: Requesting to approve as modified. The modification clarifies the charging language in response to the feedback received

from the committee at the April hearings.

The questions included in the committee's reason are addressed below. More information on the proposed system, its development and evaluation is posted here: www.homeinnovation.com/epw. Because of a publishing error, the reason statement was not included in the proposal monograph or the errata contributing to a lack of clarity during the committee deliberations. The primary goal of the proposed provisions is to include an option for an energy efficient wall constructed using conventional framing methods with a few basic modifications.

By including the proposed provisions in the IRC, the designer is provided with a prescriptive solution for constructing a standard house up to two stories in height. As with any other system in the IRC, there is always an option to engineer specific details for more complex house configurations. The system is designed not to rely on the foam for structural capacity. The system has been extensively tested and several demonstration homes have been constructed. The structural performance meets and, in most cases, exceeds the minimum performance requirements. The uplift requirements are specifically addressed in section R602.13.8 of the proposed provisions and the system is limited to the wind zones within the prescriptive limitations of the IRC. Construction practices for supporting points loads are the same as with a standard 2x4 stud wall system as required in Chapter 6 of the IRC. The nailing between stories is also the same as for any standard wood-frame wall system in Chapter 6 of the IRC.

Bibliography: www.homeinnovation.com/EPW

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal provides a new construction option for compliance with the energy code. It does not impose any new requirements.

Public Comment# 1643

Public Comment 2:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Submitted

Commenter's Reason: The proposal should be approved as submitted to agree with committee action on RB212 Part 2 recommending approval as submitted. The RB committee discussion and reason for disapproval did not properly represent the merits of the proposal and there was no opportunity to address concerns brought up or clarified after testimony during committee discussion. Thus, a response to the committee's reason statement is addressed below.

First, the whole reason for the extended plate wall technology is because "*foam is not structural*". Consequently, it does not rely on the foam being used in a structural capacity. Instead the extended plate wall integrates foam sheathing into conventional wood framing and under wood sheathing to minimize structural impact and improve overall constructability by allowing wood sheathing to serve both as a structural bracing material and as a nail base material directly behind cladding. The wall system has been engineered, tested for shear and gravity loading, and proven in four case studies of actual homes built using the technology. Like conventional wood framing, it does not "*need to be an engineered system*" for every use which creates and unnecessary barrier to innovation by putting this new wall construction technology using commodity materials at an economic disadvantage. Instead, the engineering knowledge behind this non-proprietary technology was used to develop prescriptive provisions for use, as done for conventional wood framing, steel framing, insulating concrete forms, structural insulated panels and other technologies included in the IRC.

Regarding "*point loads from roof trusses*", roof trusses and girder trusses (or point loads in general) are handled the same as a conventional 2x4 wall. There is no difference created and the same practices and limitations in the code for 2x4 wall construction to resist gravity and wind loads are applicable to the extended plate wall technology as proposed. A stack of multiple built-up studs or use of a column are typical solutions applicable to both extended plate walls and conventional wood framing without extended plates. Regarding "*concerns for uplift*" and "*nailing between 1st and 2nd floor*", there is no difference with regard to conventional 2x construction since the same fastening schedule is required for plates to roofs and floors. In addition, there are suitable proprietary connectors available where additional uplift or shear capacity is needed, just as the case with conventional wood framing without extended plates. In cases where wind or seismic loads are out-of-scope of the IRC prescriptive provisions, an engineered design would be required, just as it is for other construction methods recognized in the IRC.

Finally, the proposal has been vetted through various experts, has sought and considered input from interested parties, and has been proven ready for adoption through four actual case study homes including site built and panelized construction. We urge your support as this proposal provides a useful option for wall construction to satisfy the structural requirements of the IRC and the energy code requirements of the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The original proposal (and this PC for as submitted) has at worst no cost impact because it is adding an optional construction method to the code. However, it may reduce cost for applications where continuous insulation is being used for energy code compliance or improved thermal and moisture performance.

Public Comment# 1625

Public Comment 3:

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests Disapprove

Commenter's Reason: The American Wood Council (AWC) supports the action for DISAPPROVAL and shares many of the concerns which have already been identified by the IRC-B committee. With the complexity of the requirements for sheathing nailing, framing alignment for gravity, and load path for wind uplift, we feel the proposed system should be addressed through an engineering analysis. Based on the committee reason statement, AWC supports the committee action for DISAPPROVAL.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1574

RB212-19 Part II

IECC@: R402.1.6 (New), TABLE R402.1.2

Proposed Change as Submitted

Proponents: Vladimir Kochkin, Home Innovation Research Labs, representing Home Innovation Research Labs (vkochkin@homeinnovation.com); Patricia Gunderson, Home Innovation Research Labs, representing Home Innovation Research Labs (pgunderson@homeinnovation.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.1.6 Extended Plate Wall (EPW). EPW wall systems constructed in accordance with all applicable provisions of Sections R602.1 through R602.13 of the International Residential Code shall be considered to be in compliance with continuous insulation provisions of Table R402.1.2. For use with the prescriptive minimum insulation requirements, the foam plastic insulating sheathing layer installed outboard of the studs and the cavity insulation shall be in accordance with the required levels of insulation specified in Table R402.1.2.

**TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASSWALL R-VALUE ^f	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^c WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^{h, i}	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^{h, i}	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^{h, i} or 13+10 ^{h, i}	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^{h, i} or 13+10 ^{h, i}	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

- a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

- j. EPW wood-frame wall system utilizing foam plastic and cavity insulation equal to or exceeding the prescribed R-values shall satisfy the prescriptive minimum insulation requirements for CZ 3-8.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: The change is a useful solution for flexibility in design and efficiency (Vote: 7-4).

Assembly Action:

None

RB212-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Matt Archer, representing City of Lone Tree (matt.archer@cityoflonetree.com)

requests Disapprove

Commenter's Reason: Part II will need to be disapproved if Part I is not approved at Public Comment. Without Part I, Part II is meaningless and cannot be applied.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2127

Public Comment 2:

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests Disapprove

Commenter's Reason: Part 1 of this proposal was recommended for DISAPPROVAL by the IRC-B Committee (10-1) for engineering reasons and therefore Section 602.13 would not exist, but would be referenced in this proposal if both Parts I and Part II would follow the recommendation of the committee. In regard to why Part I was disapproved, AWC review shares many of the same concerns identified by the IRC-B Committee. Due to complexity of requirements for sheathing nailing, framing alignment for gravity, and load path for wind uplift we felt this proposed system should be addressed through an engineered design.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1592

RB213-19

IRC@: R608.1

Proposed Change as Submitted

Proponents: Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

2018 International Residential Code

Revise as follows:

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ~~or ACI 318, or ACI 332.~~ Where PCA 100, ACI 318, ACI 332 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

Reason: This change updates the exterior concrete wall construction section, R608.1, by including a reference to ACI 332 Residential Code Requirements for Structural Concrete. ACI 332 addresses the design and construction concrete basement or foundation walls constructed with removable forms or with flat insulating concrete forms. ACI 332 is already a referenced standard in section R404.1.3 of the 2018 IRC which also deals with the design of concrete foundation walls.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It simply puts in a reference to a standard that was overlooked.

RB213-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The proposal provides for options consistent with ACI. (Vote: 11-0)

Assembly Action:

None

RB213-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R608.1, R608.5.1

Proponents:

Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Samuel Steele, Seattle Department of Construction and Inspections, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ACI 318, or ACI 332. Where PCA 100, ACI 318, ACI 332 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

R608.5.1 Concrete and materials for concrete. Materials used in concrete, and the concrete itself, shall conform to requirements of this section, PCA 100, ~~or ACI 318, or ACI 332.~~

Commenter's Reason: The original code change proponent requests that a reference to ACI 332 Residential Code Requirements for Structural Concrete be added to a code section that was overlooked when the code change was drafted. This reference allows concrete, or materials used in concrete, to comply with ACI 332 where used in the design of exterior concrete walls. The ability to design to ACI 318 or PCA 100 is retained.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. Adding a reference from this section to ACI 332 further clarifies that exterior concrete walls in residential construction can be designed using ACI 332 instead of ACI 318. Designers will choose the most cost effective standard for the project, potentially resulting in a decrease in the cost of construction.

Public Comment# 1242

RB219-19

IRC: R702.7, R702.7.3

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Residential Code

Revise as follows:

R702.7 Vapor retarders. Class I, ~~or~~ II or III vapor retarders are required on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

R702.7.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table R702.7.1 is met.

**TABLE R702.7.1
CLASS III VAPOR RETARDERS**

Portions of table not shown remain unchanged.

CLIMATEZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:^a
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R702.7.2 Material vapor retarder class. The *vapor retarder class* shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

1. Class I: Sheet polyethylene, on perforated aluminum foil.
2. Class II: Kraft-faced fiberglass batts.
3. Class III: Latex or enamel paint.

Revise as follows:

R702.7.3 Minimum clear airspaces and vented openings for vented cladding. ~~For the purposes of this section, vented~~ Vented cladding shall include ~~the following minimum clear airspaces: a minimum 3/16-inch (4.8 mm) airspace.~~ Other openings with the equivalent vent area shall be permitted.

- ~~1. Vinyl polypropylene or horizontal aluminum siding applied over a weather resistive barrier as specified in Table R703.3(1).~~
- ~~2. Brick veneer with a clear airspace as specified in Table R703.8.4(1).~~
- ~~3. Other approved vented claddings.~~

Reason: First, as written the section title R402.7.3 **Minimum clear airspaces and vented openings for vented cladding** does not match the code language below which is defining vented cladding. It appears that vented cladding is being used as an example of what minimum clear air spaces is but it is very confusing and most are unclear what the section is trying to do. If vented cladding needs to be defined a new section should be create to do so. In my option it does not need to be defined, but the minimum clear airspace certainly does.

As we know vapor retarders are designed to stop or limit the amount of moisture that can diffuse into a building assembly. They however do not stop moisture that moves with air and science has determined that 90 plus percent of the moisture that enters our building assemblies gets there via air leakage vs. vapor diffusion. Therefore, our concern regarding trapping moisture in assemblies and the drying potential of the assemblies we build is on the rise. With that in mind this proposal is striving to attain two things. First a realization that the choice of vapor retarder that is used should be based on the structure and the climate that structure is built in. We should dictate that a vapor retarder is installed, but not proclaim that only one type is best for a specific climate zone. Second, specifically when class three vapor retarders are used it has been shown that the vented space does not need to be more than 3/16 of an inch. The structure of the code does not called out the size of the vented opening which is causing builders to be forced to use class one and two vapor retarders when class three retarders would actually be the best choice for their climate and structure. This occurs because jurisdictions do not have better guidance than some random examples of gaps size behind vented cladding that is currently given in the code. This is especially true in dry climate zones but is an issue everywhere.

In Joe Lstiburek's article titled "Wufi – Barking up the Wrong Tree" he demonstrates that wood siding that is installed over a 3/16" gap has air movement behind it that is equivalently to approximately 20 air changes per hour. See table 2 cladding ventilation/sheathing ventilation. Lstiburek continues in his article titled, "Hockey Pucks and Hydrostatic Pressure" to demonstrate the "you need to install wood siding and trim over a small gap to control hydrostatic pressure. This gap can be as small as 1/4" and the spacer can be a strip of thin foam" such as sill seal which is what is pictured in the photographs that accompany the paper.

Bibliography: BSD-106: Understanding Vapor Barriers, by Joseph Lstiburek
<http://buildingscience.com/documents/digests/bsd-106-understanding-vapor-barriers>

BSI-089: Wufi – Barking up the Wrong Tree, by Joseph Lstiburek

<https://buildingscience.com/documents/building-science-insights-newsletters/bsi-089-wufi%E2%80%94barking-wrong-tree>

BS_057: Hockey Pucks and Hydrostatic Pressure, by Joseph Lstiburek

<https://buildingscience.com/documents/insights/bsi-057-hockey-pucks-and-hydrostatic-pressure>

RR-0999: Drainage Planes and Air Spaces, by Joseph Lstiburek

<https://buildingscience.com/documents/reports/rr-9909-drainage-planes-and-air-spaces/view>

You don't need a Vapor Barrier, By Allison Bailes with the Energy Vanguard

<http://www.energyvanguard.com/blog-building-science-HERS-BPI/bid/54110/You-Don-t-Need-a-Vapor-Barrier-Probably>

Are Vapor Barriers Required or Recommended?

BY JUAN RODRIGUEZ Updated December 30, 2018

<https://www.thebalancesmb.com/what-is-a-vapor-barrier-845075>

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Cost Statement:

There are no construction cost increases associated with the clarification and flexibility that are achieved through this code change proposal

RB219-19

Public Hearing Results

Errata: This proposal includes the following errata
In Section R702.7.3 Item 2, the correct reference is Table R703.8.4(1).

Committee Action:

Disapproved

Committee Reason: The committee felt that the proposal could be further clarified to make it clear that these provisions apply only to Class III vapor retarders. Further, the cost impact says there is no cost impact, but the committee felt that there would be an increase in cost with this proposal. (Vote: 9-2)

Assembly Action:

None

RB219-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R702.7.3

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R702.7.3 Minimum clear airspaces and vented openings for vented cladding. Vented cladding shall include a minimum 3/16-inch (4.8 mm) airspace. Other openings with the equivalent vent area shall be permitted.

1. Vinyl polypropylene or horizontal aluminum siding applied over a weather-resistive barrier as specified in Table R703.3(1).
2. Brick veneer with a clear airspace as specified in Table R703.8.4(1).
3. Other approved vented claddings.

Commenter's Reason: The committee felt that this proposal could be further clarified to make it clear that these provisions apply only to Class III vapor retarders. From a code perspective, vented cladding is only required when a class III vapor retarder is used. Section R702.7.1 Class III vapor retarders is specific states that, "Class III vapor retarders shall be permitted where any one of the conditions in Table R702.7.1 is met." The table specifically defines vented cladding assemblies that can be built when using a Class III vapor retarder. There is no clarification of assemblies in this section for the other two classes of retarder. This code change proposal clarification of the size of the air space required when using a vented cladding can only be defining the vented air space required when class III vapor retarders are used.

Further, the cost impact says there is no cost impact, but the committee felt that there would be an increase in cost with this proposal. There could be a cost increase but the reality is that an air space is currently required in order to build with a class III vapor retarder so it is unlikely that an increase in cost would be associated with the clarification of the size of the air space that is needed. This is why the cost statement stated that no construction cost increase would be associated with the clarification and flexibility that are achieved through this code change proposal.

The Public Comment does bring back a section of code language that was added back in by floor modification Weston-1 and was heard by the committee. This is in Section 702.7.3 and the language that was added back in this public comment has been underlined.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There are no construction cost increases associated with the clarification and flexibility that are achieved through this code change proposal.

Public Comment# 1838

RB221-19

IRC: R702.7, R702.7.4(New)

Proposed Change as Submitted

Proponents: Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

2018 International Residential Code

Revise as follows:

R702.7 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4 to protect the exterior wall assembly against condensation. Vapor retarders shall be installed in accordance with Section R702.7.4.

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

Add new text as follows:

702.7.4 Installation Vapor retarders shall be installed in accordance with the manufacturer’s instructions or an approved design. The vapor retarder shall be installed as an air barrier or in conjunction with an air barrier.

Reason: For vapor retarders to perform as intended, they need to be installed as or in conjunction with an air barrier.

Air leakage control is currently dealt with in the I-codes based on energy efficiency considerations, but it is also critical to protection against moisture condensation. Air leakage can move 100x more moisture than vapor diffusion, and vapor retarders will not work properly without air leakage control. As stated in the Whole Building Design Guide:

“Moisture contributed by air leakage is a significant source and should be a serious concern in the design of the wall system. In fact, the design of the building envelope for minimizing air leakage is more critical than the design of the vapor barrier. To illustrate this point, consider that the amount of moisture contributed to a building by the air that flows through a crack 1/16th inch thick by 1 foot long is just over 5 pints per day in a light breeze. In contrast, the amount of moisture contributed by vapor diffusion through a 10 foot by 50-foot painted block wall over the same period equals just under 1/3 of a pint (about 5 ounces).”

It is important to include air leakage control in Section R702.7 as it will highlight its importance to moisture management and facilitate the inclusion of air leakage control in water management details.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal should neither increase nor decrease the cost of construction, as its intention is to ensure that an existing requirement is installed in an effective manner.

RB221-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved because "approved design" is too broad and unclear. (Vote: 9-2)

Assembly Action:

None

RB221-19

Individual Consideration Agenda

Public Comment 1:

IRC®: 702.7.4 (New)

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

702.7.4 Installation Vapor retarders shall be installed in accordance with the manufacturer's instructions ~~or an approved design~~. The vapor retarder shall be installed as an air barrier or in conjunction with an air barrier.

Commenter's Reason: The committee expressed concerns about meaning of "an approved design" at the Committee Action Hearing and indicated they would like to see a public comment. This proposal addresses the committee concerns by removing the language. Please refer to the original reason statement regarding the intent of this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal should neither increase nor decrease the cost of construction, as its intention is to ensure that an existing requirement is installed in an effective manner.

Public Comment# 2028

RB231-19

IRC@: R703.2

Proposed Change as Submitted

Proponents: Paul Coats, representing American Wood Council (pcoats@awc.org)

2018 International Residential Code

Revise as follows:

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. No.15 asphalt felt shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). Other *approved* materials shall be installed in accordance with the *water-resistive barrier* manufacturer's installation instructions. The No. 15 asphalt felt or other approved *water-resistive barrier* material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: A water-resistive barrier shall not be required in detached accessory structures that are not heated or cooled.

Reason: For many years the code exempted accessory structures from the requirement for a water resistive barrier. The exception was removed from the code in the previous cycle, but the exception that was removed applied to all accessory structures, regardless of their purpose and regardless of whether they were heated or cooled. This proposal will not exempt conditioned (heated or cooled) accessory structures, which are more subject to movement of moisture through the exterior walls than unconditioned ones. Unconditioned detached accessory structures such as sheds and storage structures have a proven record of performance when complying with the normal siding installation requirements without a water resistive barrier as defined in the code. Unconditioned structures are typically used to store yard tools, lawn mowers, tractors, hay, boats, road salts, including certain amounts of fume-producing fuels and lubricants. They often do not have interior wall coverings or insulation, but instead have exposed framing with siding and no wall sheathing. Installing a water resistive barrier directly to framing without wall sheathing is difficult, and the barrier would be easily punctured by yard tools or other objects leaning against the walls. In addition, they could hinder the natural ventilation needed to disperse fumes and heat. Structures that are heated or cooled are more likely to have insulation and therefore the water resistive barrier makes sense, but an exception is needed for unconditioned structures which have been adequately served by the siding provisions in the code.

Cost Impact: The code change proposal will decrease the cost of construction
This may decrease the cost of construction for certain unconditioned accessory structures.

RB231-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The committee felt that this was a reasonable allowance for small accessory structures that will typically not have interior finishes. (Vote: 6-4)

Assembly Action:

None

RB231-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests Disapprove

Commenter's Reason: The committee vote was 6-4 in support of this proposal as submitted. We are requesting disapproval given the obvious potential for structural sheathing water damage due to the added exposure to liquid water without a water-resistive barrier.

Water-resistive barriers are needed for both conditioned and unconditioned structures. A water-resistive barrier is designed to act as a secondary drainage plane for liquid moisture that gets behind the cladding in conditions such as wind-driven rain. There is no evidence submitted that unconditioned structures have less exposure in the secondary drainage plane compared to conditioned structures. Therefore, the assumption is that there is sufficient drying potential with an empty cavity to offset the added wetting potential without the water-resistive barrier.

There is precedence for this approach based upon historical experience with open stud construction, where the exterior sheathing is directly exposed to an open cavity. We oppose this code change because there is no requirement for open stud construction in this proposal. The addition of interior insulation, vapor barrier, gypsum, etc., could limit the drying potential and have unintended consequences.

The historical practice of open stud construction in detached structures does not necessarily predict the future use of these structures, given the rising cost of construction, multi-generational housing, working at home and the need to convert unfinished to finished spaces to avoid having to relocate to a larger home. Tiny homes and storage shed home offices have emerged as practical solutions to these issues. Detached structures should be protected by a minimal cost water-resistive barrier that will protect the structure over its lifetime.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 2030

RB238-19

IRC@: R703.4

Proposed Change as Submitted

Proponents: Donald Sivigny, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Revise as follows:

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. An insulation stop shall be installed around all window and door openings, 1 to 2 inches inward from the face of the exterior sheathing, to allow for drainage of incidental water at the window or door flashing system. Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
 - 1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
 - 1.2. In accordance with the flashing design or method of a registered design professional.
 - 1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Reason: This change will increase the durability of the wall assembly when integrating a fenestration product into the assembly. This code change will enhance the opportunity for water drainage in accordance with the remainder of Section R703.4 to specifically address water drainage at the pan flashing. This proposal provides the opportunity to install fenestration product in compliance with both the Energy Code and the installation instructions of the fenestration manufacturer, by enhancing the drainage of pan flashed fenestration products. The Energy code requires the fenestration products and the framed openings to be insulated and sealed. The installers of these fenestration units almost exclusively use expanding spray foam as a sealant to meet the Energy Codes. When this expanding foam or other sealant flows outward to, or extends to the exterior nailing flange, it actually blocks the free drainage of water to the exterior, allowing water to collect and wick inward through capillary action toward the interior of the exterior wall assembly where it will cause degradation of the wall assembly. Maintaining an unobstructed and drainable air space around the perimeter of the fenestration product, and especially the pan flashing, will allow for convective air flow that promotes drying and will elevate water infiltration to the wall assembly. This can be accomplished by installing a barrier or stop to prevent the expanding foam or other sealants from reaching the interior side of the nailing flange where it will create degradation issues within the wall assembly. Unobstructed drainage is essential to the draining of water where the fenestration products interface with the wall assemblies. The existing code language does not have any specific, or enforceable language to require an unobstructed drainage plane at all fenestration products. This code change proposal does not interfere with or override the specific installation instruction of fenestration products into walls assemblies by the manufacturer or the code, but instead, it simply enhances the ability of the wall assembly to drain water and maintain a dry and durable assembly for years to come.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change proposal initially may increase or decrease the cost of construction slightly in material, depending on the manufacturer's installation instructions, however any increase in these cost will more than recovered in the longevity of the assembly and addressing those problems of degradation of wall assemblies at these openings when it is not allowed to drain fully and stay dry. Remember the cost of a Call back to a home is around \$350 or above on average.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. ~~An insulation stop~~ Air sealing shall be installed around all window and door openings on the interior side of the rough opening gap, 1 to 2 inches inward from the face of the exterior sheathing, to allow for drainage of incidental water at the window or door flashing system. Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:

- 1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
- 1.2. In accordance with the flashing design or method of a registered design professional.
- 1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Committee Reason: The modification makes the proposal product neutral, and clarifies that the intent is to allow for water to drain out. The modification also inserts correct code language and has the physics correct. The committee agreed with the intent of the original proposal, but thought it was too limiting without the modification. (Vote: 11-0)

Assembly Action:

None

RB238-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R703.4

Proponents:

Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. Air sealing shall be installed around all window and door openings ~~on the interior side of the rough opening gap~~ Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
 - 1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
 - 1.2. In accordance with the flashing design or method of a registered design professional.
 - 1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Commenter's Reason: We are not opposed to the intent of the proposal and appreciate the modification made to the original proposal at the Committee Action Hearings, however after subsequent consideration, further modification to remove "on the interior side of the rough opening gap" is needed. Our concern is the same as for any amendment to R703.4 that may be proposed – provisions that are unclear and/or that may conflict with the manufacturer's installation instructions. With respect to this proposal, it is not clear exactly what "on the interior side of the rough opening gap" is, therefore leaving it open to interpretation, and it may also conflict with the manufacturer's installation instructions covering air sealing around the window or door. The language is simply not needed to accomplish the intent of the proposal and given the potential problems that can result from it, it needs to be removed.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. While not in every case, this proposal will decrease the cost of construction by alleviating unclear language that is open to interpretation which could include installation methods or applications that are not necessary and when there is a conflict with a manufacturer's installation instruction which can result in delays while the matter is being resolved or requiring modifications to the installation instructions when they are not necessary.

RB241-19

IRC@: R703.7, R703.7.1, R703.7.3, 703.7.3.1 (New)

Proposed Change as Submitted

Proponents: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org); Gary Ehrlich, National Association of Home Builders, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

R703.7 Exterior plaster (stucco). Installation of exterior plaster shall be in compliance with ASTM C926, ASTM C1063 and the provisions of this code.

Revise as follows:

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063, expanded metal, welded wire, or woven wire lath shall be attached to wood framing members with 1¹/₂-inch-long (38 mm), 11-gage nails having a ⁷/₁₆-inch (11.1 mm) head, or ⁷/₈-inch-long (22.2 mm), 16-gage staples, spaced not more than 6 7 inches (152 178 mm) on center vertically and not more than 24 inches on center horizontally, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Sections R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Sections R703.15, R703.16, or R703.17.

Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive, vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section R703.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.

Exception: Where the *water-resistive barrier* that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

Add new text as follows:

703.7.3.1 Furring Where provided, furring between lath and vertical supports or solid sheathing shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum 3/4 inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063. Furring shall be spaced a maximum of 24 inches (600 mm) on center horizontally and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Reason: The purpose of this code change is to correlate the requirements for exterior lath and plaster (stucco) with the requirements of ASTM C 926 and C 1063 and recommended practice. The code requirements in the IRC are not in alignment with the reference standards and lack key details needed to insure a good installation and minimize the risk of moisture intrusion. In particular, the IRC lath attachment requirements state a 6" nail or staple spacing but do not specify direction or what nailing substrates are permitted. ASTM C 1063 specifies a 7" vertical spacing along and 16" to 24" horizontal spacing into wood studs. Without this clear direction in the code, some stucco is being installed with fasteners in a 6" grid pattern (both horizontal and vertical), leading to fasteners penetrating sheathing and providing a path for moisture intrusion behind the WRB and exterior sheathing and causing decay and water damage. The code user is referred to C 1063 for lath attachment requirements for other substrates, and is allowed to omit the lath when permitted by C 1063 for concrete substrates which have been properly prepared such that the plaster will bond directly to the concrete.

Also, the IRC does not currently provide any details for furring. Minimum sizes consistent with other wood furring requirements in the IRC and the minimum channel size from C 1063 are supplied along with the maximum horizontal spacing. Again, the proposed language underscores that furring attachment to metal or wood framing must be into studs. Where furring is required between lath and vertical supports or solid surfaces varies depending on the type of lath or plaster base used and the type of vertical support or surface. Designers and stucco installers should defer to C 1063 and stucco manufacturer instructions for guidance on where furring is required.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The code change aligns the prescriptive language for exterior lath and plaster in the IRC with the ASTM standards referenced in the section. Since compliance with these standards is already required, this change simply provides clarification for builders, stucco installers and building officials and thus does not increase the cost of construction.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063. expanded metal, welded wire, or woven wire lath shall be attached to wood framing members or furring with 1½-inch-long (38 mm), 11-gage nails having a 7/16-inch (11.1 mm) head, or 7/8-inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring vertically and not more than 24 inches on center between framing members or furring horizontally, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Sections R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Sections R703.15, R703.16, or R703.17.

Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

~~703.7.3.1~~ **703.7.1.1 Furring.** Where provided, furring ~~between lath and vertical supports or solid sheathing~~ shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum ¾ inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063. Furring shall be spaced a maximum of 24 inches (600 mm) on center ~~horizontally~~ and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Committee Reason: The modification improved the language related to furring attachments. The new section on furring was relocated to under the existing section on lath for the correct application of requirements. The proposal correlates exterior lath and plaster with the requirements of ASTM C926 and C1063. This will improve the understanding of correct spacing. (Vote: 10-0)

Assembly Action:

None

RB241-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R703.7.1

Proponents:

Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063. expanded metal, welded wire, or woven wire lath. The lath shall be attached to wood framing members or furring. Where the exterior plaster is serving as wall bracing in accordance with Table R602.10.4, the lath shall be attached directly to framing. The lath shall be attached with 1½-inch-long (38 mm), 11-gage nails having a 7/16-inch (11.1 mm) head, or 7/8-inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring and not more than 24 inches on center between framing members or furring , or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Sections R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Sections R703.15, R703.16, or R703.17.

Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

Commenter's Reason: Table R602.10.4 permits exterior plaster (stucco) as a wall bracing material and references Section R703.7 for framing. RB241, if not modified by this public comment, could result in required wall bracing being installed on wall furring that is perpendicular to and only

fastened to supporting framing at 24 inches on center. If this construction were to occur, the stucco would be ineffective as wall bracing. The proposed public comment language makes clear that installation on furring is only permitted where the exterior plaster is not serving as required bracing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change proposal permitted an alternative installation. The public comment narrows where the alternative construction is permitted. Neither one should have an impact on construction cost.

Public Comment# 1407

RB242-19

IRC: R703.7.3, R703.7.3.1(New), R703.7.3.2(New)

Proposed Change as Submitted

Proponents: Mike Fischer, representing Self (mfischer@kellencompany.com); Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2018 International Residential Code

Revise as follows:

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall ~~comply with Section R703.7.3.1 or Section R703.7.3.2, include a water-resistive, vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, is directed between the layers.~~

Exception: ~~Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.~~

Add new text as follows:

R703.7.3.1 Dry Climates. In dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, shall be directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water-absorbing layer.

R703.7.3.2 Moist or marine climates. In the moist (A) or marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. In addition to complying with Section R703.7.3.1, a space not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
2. In addition to complying with Section R703.7.3.1 Item 2, a space having a drainage efficiency of not less than 90%, as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925, shall be added to the exterior side of the water-resistive barrier.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM E2925-17: Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function

Reason: The proposal does two things. First, it reorganizes the provisions by deleting an exception (which is really a construction option) and replacing it with subsections that indicate different methods of complying with stucco water-resistive barrier requirements. Second, the proposal properly applies requirements in relation to climate -- something that has been missing in the code and is needed to avoid higher risk of moisture problems in climates that are moist/rainy. The proposal will help resolve problems with stucco performance (e.g., moisture problems over wood-based sheathings) and avoid impacting cost or performance where performance has a long-standing record of good performance (e.g., dry climates such as the southwestern region of the U.S.).

Cost Impact: The code change proposal will increase the cost of construction

The proposal will not increase cost for substrates other than wood-based sheathing. Also, it will not impact cost or change requirements in dry climates where stucco has a long record of successful performance. This also will not impact cost in moist or marine climates where similar actions are already being taken (e.g., a drainage space) to reduce risk of moisture damage.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E2925-17, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB242-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R703.7.3.1 Dry Climates. In dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, shall be directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water- absorbing layer, or a designed drainage space.

R703.7.3.2 Moist or marine climates. In the moist (A) or marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
2. In addition to complying with Section R703.7.3.1 Item 2, drainage on the exterior side of the water-resistive barrier shall have a space having a drainage efficiency of not less than 90%, as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925, ~~shall be added to the exterior side of the water-resistive barrier.~~

Committee Reason: The modification adds options for water resistive barriers. The proposal provides appropriate water resistive barriers for use with wood based sheathing and exterior plaster.

Assembly Action:

None

Staff Analysis: The proposals for RB242, RB243, RB244, RB245 and RB246 need to be coordinated.

RB242-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R703.7.3.1 (New)

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R703.7.3.1 Dry Climates. In dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, shall be directed between the layers.
2. water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type I or II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water- absorbing layer, or a designed drainage space.

Commenter's Reason: This change brings RB242 into compliance/coordinates with RB243 which also passed. The requirement for meeting Type II is too restrictive and prevents the use of successfully performing less expensive alternatives such as fluid applied water control layers and integral water control layers incorporated into sheathing. The key performance requirement is drainage. With drainage as defined or the space as it is defined Type II

materials are not necessary. This modification recognizes that the most important factor relating to addressing the issues with stucco are drainage not the resistance to hydrostatic pressure. In other words drainage is more important than requiring a Type II water resistive barrier. A Type I water resistive barrier with drainage significantly outperforms a Type II water resistive barrier without drainage. ASTM E2556 does not address drainage. ASTM E2556 requires materials to resist a water column of over 20 inches of water...a hydrostatic pressure greater than 5,000 pascals (an equivalent wind speed of 200 hundred miles per hour). The requirement is disingenuous when it is understood that sheet membranes are tested under ASTM E2556 without fasteners. Nails are required to install such products...as well as other products. Cladding fasteners then penetrate all products. The key is to control the hydrostatic pressure so the holes don't matter.

Requiring a Type II water resistive barrier creates an artificial barrier to entry for products and approaches that have been demonstrated to work. It excludes products such as OSB sheathings with integral water control layers manufactured by Georgia Pacific, Louisiana Pacific and Huber. It excludes many fluid applied water resistive barriers and it adds unnecessary expense to drainage mat and dimple matt drainage approaches where Type I water resistive barriers function well. Requiring Type II water resistive barriers favors mechanically attached sheet good based water resistive barriers despite evidence that they do not function adequately in stucco assemblies without a gap.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code change decreases costs.

Requiring materials to meet Type II requirements significantly increases costs relative to meeting Type I requirements. This requirement doubles the material cost per square foot of water resistive barriers resulting in costs on the order of hundreds of dollars per typical single family residential home. Therefore, this code change significantly reduces the cost of construction by hundreds of dollars per typical single family residential home.

Public Comment# 1936

Public Comment 2:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Committee

Commenter's Reason: We request this proposal be approved in accordance with the Committee Action at the CAH.
The proponents testified that:

- The structure of this proposal is useful in that the more restrictive provisions are located in the main body of the text instead of placing these provisions in the exception statement.
- The problem to be solved is moisture performance issues with stucco in moist and marine climate zones. The reason for the problem is that dry climate zone installation techniques, currently required by code, are inadequate to reduce risk of moisture damage and do not provide for adequate drainage behind the stucco.
- The proposal breaks the requirements into a dry and moist/marine climate zone solution. There is a prescriptive solution – a 3/16" gap or drainage material and a performance solution which is a drainage efficiency requirement in accordance with ASTM standards.
- The water-resistive barrier requirements are retained as currently prescribed by code, and are specified in accordance with ASTM E2556, Type II, which has been in the code since 2006 and a part of ICC-ES AC-11 requirements beforehand.
- Opposition to the proposal supported the air gap and drainage plane, but also wanted to lower the WRB moisture performance by changing from a Type II down to a Type I. This was the intent of the other stucco proposals RB243/S194. This was not our original intent, as we have no supporting data or long-term performance studies to support this approach, either on a material or an assembly basis. Furthermore, the IBC-S committee ruled against S194 on lowering the WRB requirement, but both committees supported our proposals (RB242/S196) to add the air gap/drainage plane.

RB242 is consistent with S196 which is the stucco proposal recommended for approval by IBC-S committee. For the above reasons and to maintain consistency between the IRC and IBC, we therefore request your support of the committee action for approval of RB242 as modified.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Refer to the cost impact statement in the original RB242 proposal. It is unchanged.

Public Comment# 1737

RB243-19

IRC@: R703.7.3, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Residential Code

Revise as follows:

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive, ~~vapor-permeable~~ barrier with a performance water resistance at least equivalent to two layers of Grade D paper ~~or two layers of water-resistive barrier complying with ASTM E2556~~. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section R703.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of ~~60-minute Grade D paper~~ a water-resistive barrier complying with ASTM E2556 Type I and is separated from the stucco by an intervening, ~~substantially nonwater-absorbing layer or designed drainage~~ foam plastic insulating sheathing layer or by a minimum 3/16 inch (5 mm) space.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E2556/E2556M—10: Standard Specification for Vapor Permeable Flexible Sheet Water-resistive Barriers Intended for Mechanical Attachment

Reason: Objective:

1. Define water resistance as the primary functional requirement of the WRB and remove reference to vapor permeable.
2. Enable a single layer of WRB complying with ASTM E2556 Type I with a drainage space.
3. Define depths drainage space

The existing code language gives insufficient guidance for other approved materials. The added language addresses this issue and provides a specific performance requirement for water resistance and provides consistency with other sections of the code that relate specifically to water-resistive barriers.

The size of the drainage space needs to be specified. Type 1 is the appropriate water-resistive metric for the specified space. This logic is consistent with the body and intent of the text of Section R703.7.3. The specified space and one layer of Type 1 provides equivalent performance to the two layers of Type 1 specified in the body of R703.7.3.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change gives better guidance for water-resistance.

Staff Analysis: The referenced standard, ASTM E2556/E2556M-10, is currently referenced in other 2018 I-codes.

RB243-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive, barrier with a water resistance at least equivalent to two layers of Grade D paper or two layers of water-resistive barrier complying with ASTM E2556. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section R703.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-

minute Grade D paper or a water-resistive barrier complying with ASTM E2556 Type I and is separated from the stucco by an intervening foam plastic insulating sheathing layer or by a minimum 3/16 inch (5 mm) space or a drainage layer having a drainage efficiency of not less than 90 percent as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925.

Committee Reason: The modification helps coordinate this item with RB242 by adding back in the 60 min grade D paper, to improve drainage efficiency, and indicates that a drainage gap is needed. The choice of a single layer is offered. (Vote: 10-1)

Assembly Action:

None

Staff Analysis: The proposals for RB242, RB243, RB244, RB245 and RB246 need to be coordinated.

RB243-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests Disapprove

Commenter's Reason: RB243 is not consistent with RB242 and S196, both of which were recommended for approval as modified by the IRC-B and IBC-S committees. There are several reasons for disapproving RB243. First, S194 (similar to RB243) was recommended for disapproval by the IBC-S committee. Therefore, disapproving RB243 will better ensure that the IRC and IBC stucco WRB provisions are coordinated. Second, disapproving RB243 will ensure there are no technical and formatting conflicts with regard to coordinating RB242 and RB243 for the IRC. For example, RB242 is formatted to clarify under what climate conditions additional drainage or gap is required. Conversely, RB243 lacks this formatting which is needed to give direction for where to use a drainage gap (and also where it is not needed). In addition, RB243 creates a technical conflict within the exception by referring to ASTM E2556 Type I and 60-minute Grade D paper which implies they have equivalent water-resistance. They are not equivalent; 60-minute Grade D paper is Type II in accordance with ASTM E2556 and has a greater water-resistance than Type I (e.g., 10-minute Grade D paper). Type II (i.e., 60-minute Grade D paper) has been the accepted minimum requirement since 2006 and in ICC-ES evaluation criteria prior to that time. This should not be changed without substantiating evidence.

In closing, RB242 and S196 provide a more complete, better formatted, coordinated, and technically robust provision for the IRC and IBC, respectively. Disapproving RB243 will ensure that intent is maintained.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1742

RB248-19

IRC@: TABLE R703.8.4(1)

Proposed Change as Submitted

Proponents: Charles Clark Jr, Brick Industry Association, representing Brick Industry Association (cclark@bia.org)

2018 International Residential Code

Revise as follows:

**TABLE R703.8.4(1)
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS**

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER^{a,c}	AIRSPACE^{e,b}	
Wood stud backing with corrugated sheet metal	22 U.S. gage(0.0299 in.) x 7/8 in. wide	8d common nail ^{b,c} (2 1/2 in. x 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint ^d	8d common nail ^{b,c} (2 1/2 in. x 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum 4 7/8 4 5/8 in. between backing and veneer
Wood stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint ^{e,f}	8d common nail ^c (2 1/2 in. x 0.131 in.)	Greater than 4 5/8 in. between backing and veneer	Maximum 6 5/8 in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint ^d	No. 10 screw extending through the steel framing a minimum of three exposed threads	Minimum nominal 1 in. between sheathing and veneer	Maximum 4 7/8 4 5/8 in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint ^{e,f}	No. 10 screw extending through the steel framing a minimum of three exposed threads	Greater than 4 5/8 in. between backing and veneer	Maximum 6 5/8 in. between backing and veneer

b. a. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

e. b. An airspace that provides drainage shall be permitted to contain mortar from construction.

a. c. In Seismic Design Category D₀, D₁ or D₂, the minimum tie fastener shall be an 8d ring-shank nail (2 1/2 in. x 0.131 in.) ~~or a No. 10 screw extending through the steel framing a minimum of three exposed threads.~~

d. Adjustable tie pintle shall include a minimum of 1 pintle leg of wire size W2.8 (MW18) with a maximum offset of 1-1/4 in.

e. Adjustable tie pintle shall include a minimum of 2 pintle legs with a maximum offset of 1-1/4 in. Distance between inside face of brick and end of pintle shall be a maximum of 2 in.

f. Adjustable tie backing attachment components shall consist of one of the following: eyes with minimum wire W2.8 (MW18), barrel with minimum 1/4 in. outside dia., or plate with minimum thickness of 0.074 in. and minimum width of 1-1/4 in.

Reason: This code change proposal allows larger airspaces to be constructed between masonry veneer and backing. Larger airspaces are necessary in order to accommodate thicker continuous insulation which may be needed in colder climate zones. If adopted, the tie and airspace provisions of the IRC would match those required by the IBC through reference to the anchored masonry veneer provisions of TMS 402 Building Code Requirements for Masonry Structures. As such, they would allow masonry veneer with airspaces up to a maximum of 4-5/8 in. to be constructed using the traditional tie configurations already in the existing IRC table. They would also allow masonry veneer with airspaces greater than 4-5/8 in. up to a maximum of 6-5/8 in. to be constructed using stiffer tie configurations.

This code change proposal also adjusts the existing footnotes in the table (Footnotes a, b and c). For the footnote addressing Seismic Design Category D₀, D₁ or D₂, there is no need to include No. 10 screws as they are already required for all cold-formed steel framing. Footnotes addressing rust-inhibitive coating and construction mortar are moved to more appropriate locations.

Cost Impact: The code change proposal will increase the cost of construction. This code change proposal WILL NOT increase the cost of constructing masonry veneer with an airspace of 4-1/2 in. or smaller as currently allowed by the existing code provision. Rather, it allows the construction of masonry veneer with an airspace larger than 4-1/2 in. to a maximum of 6-5/8 in. However, masonry veneer with an airspace greater than 4-5/8 in. will be more expensive than veneer with an airspace of 4-5/8 in. or less because stiffer ties are required to span the larger airspace.

RB248-19

Public Hearing Results

Errata: This proposal includes the following errata

There are three unpublished errata to Table R703.8.4(1). They should read as follows:

In the 1st row, 3rd column - MINIMUM TIE FASTENER ^a_d

In the 5th row, 2nd column - W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint_d

In Foot note b - ~~e~~_b. An airspace that provides drainage shall be permitted to contain mortar from construction

Committee Action:

Disapproved

Committee Reason: While the committee liked the idea, the proposal was disapproved because the proposal needs fixes between the footnotes and the references in the table. (Vote: 10-1)

Assembly Action:

None

RB248-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R703.8.4(1)

Proponents:

Charles Clark Jr, representing Brick Industry Association (cclark@bia.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R703.8.4(1)
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER^{e,a}	AIRSPACE^b	
Wood stud backing with corrugated sheet metal	22 U.S. gage(0.0299 in.) x 7/8 in. wide	8d common nail ^c (2 1/2 in. x 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint ^d	8d common nail ^c (2 1/2 in. x 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum 4 5/8 in. between backing and veneer
Wood stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint ^{e,f}	8d common nail ^c (2 1/2 in. x 0.131 in.)	Greater than 4 5/8 in. between backing and veneer	Maximum 6 5/8 in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint ^d	No. 10 screw extending through the steel framing a minimum of three exposed threads	Minimum nominal 1 in. between sheathing and veneer	Maximum 4 5/8 in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint ^{e,f}	No. 10 screw extending through the steel framing a minimum of three exposed threads	Greater than 4 5/8 in. between backing and veneer	Maximum 6 5/8 in. between backing and veneer

- a. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.
- b. An airspace that provides drainage shall be permitted to contain mortar from construction.
- c. In Seismic Design Category D0, D₁ or D₂, the minimum tie fastener shall be an 8d ring-shank nail (2 1/2 in. x 0.131 in.) .
- d. Adjustable tie pintle shall include a minimum of 1 pintle leg of wire size W2.8 (MW18) with a maximum offset of 1-1/4 in.
- e. Adjustable tie pintle shall include a minimum of 2 pintle legs with a maximum offset of 1-1/4 in. Distance between inside face of brick and end of pintle shall be a maximum of 2 in.
- f. Adjustable tie backing attachment components shall consist of one of the following: eyes with minimum wire W2.8 (MW18), barrel with minimum 1/4 in. outside dia., or plate with minimum thickness of 0.074 in. and minimum width of 1-1/4 in.

Commenter's Reason: As indicated by the Committee and as reflected in their Committee Reason statement, they were in favor of the proposal but fixes were needed to the footnotes and references. This Public Comment along with the Errata published with the Public Hearing Results fixes the errors in the footnotes and references that were created by the cdpACCESS software. The specific modification made by this Public Comment indicates that footnote "a" applies to the column heading "MINIMUM TIE FASTENER" thus requiring all fasteners to have a rust-inhibitive coating or to be made from a material not susceptible to corrosion.

The overall effect of this change will be to allow wider airspaces of up to 6-5/8 in. behind anchored masonry veneer to accommodate thicker insulation. This is possible by requiring the use of stiffer veneer ties across airspaces that are wider than 4-5/8 in. Anchored masonry veneer with airspaces up to 4-5/8 in. wide will require the same veneer tie size and spacing as required in the current IRC provisions and will not be impacted by this change.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As stated in the cost impact submitted with the original proposal, this code change proposal WILL NOT increase the cost of constructing masonry veneer with an airspace of 4-1/2 in. or smaller as currently allowed by the existing code provision. Rather, it allows the construction of masonry veneer with an airspace larger than 4-1/2 in. to a maximum of 6-5/8 in. However, masonry veneer with an airspace greater than 4-5/8 in. will be more expensive than veneer with an airspace of 4-5/8 in. or less because stiffer ties are required to span the larger airspace.

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less ~~and does not show evidence of significant progressive combustion where the test is~~. In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minutes ~~-In addition, and~~ the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the extended 30-minute test.

Reason: This proposal addresses the incorrect double requirement for testing to both flame front progress and no significant progressive combustion in the extended ASTM E84 test.

This issue has been under discussion for many years at the ICC codes, as well as at ASTM and at NFPA, but can now be resolved in the IRC code. The ASTM E5 committee, responsible for ASTM E84, has now, for the first time, accepted incorporating requirements for conducting a 30 minute test. Until this change ASTM E84 did not contain any information other than that it is a 10 minute test. Consequently, until this change ASTM E84 did not provide any details on how to assess either "no evidence of significant progressive combustion" or "the flame front shall not progress more than 10 1/2 feet (3200 mm) beyond the centerline of the burners". The information for how to determine both of those characteristics is contained in ASTM E2768. The committee agreed that the next edition of ASTM E84 will state that a 30 minute test is to be conducted per ASTM E2768. In turn, ASTM E2768 explains that "no significant progressive combustion" is evidenced by lack of flame front progress beyond 10 1/2 feet. In fact ASTM E2768 states: "The flame front shall not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners at any time during the 30 min test period. This is considered evidence of no significant progressive combustion in this test method." This IBC proposal incorporates the requirements from the ASTM E84 test into the IBC and ensures that the code does not require a duplicate (and confusing) measurement.

It is likely that information will be presented stating that "no significant progressive combustion" has been in the code since the legacy codes and that the flame front progress requirement was added later. That is exactly the reason that ASTM E2768 was developed to ensure that everyone understands what is to be measured, and that is what the testing laboratories have been doing for many years now.

This change appears to alter requirements but in fact simply recognizes what the ASTM E84 standard states and what the labs are doing (and have been doing for years) and, therefore, is really clarification.

The ASTM E05 committee agreed on actions at the December 2018 meeting so that the language in ASTM E84 reads:

1. Scope

1.1 This fire-test-response standard for the comparative surface burning behavior of building materials is applicable to exposed surfaces such as walls and ceilings. The test is conducted with the specimen in the ceiling position with the surface to be evaluated exposed face down to the ignition source. The material, product, or assembly shall be capable of being mounted in the test position during the test. Thus, the specimen shall either be self-supporting by its own structural quality, held in place by added supports along the test surface, or secured from the back side.

1.2 Test Method E84 is a 10-minute fire-test response method. The following standards address testing of materials in accordance with test methods that are applications or variations of the test method or apparatus used for Test Method E84:

1.2.1 Materials required by the user to meet an extended 30-min duration tunnel test shall be tested per Test Method E2768.

1.2.2 Wires and cables for use in air-handling spaces shall be tested per NFPA 262.

1.2.3 Pneumatic tubing for control systems shall be tested per UL 1820.

1.2.4 Combustible sprinkler piping shall be tested per UL 1887.

1.2.5 Optical fiber and communications raceways for use in air handling spaces shall be tested per UL 2024.

1.3 The purpose of this test method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke developed index are reported. However, there is not necessarily a relationship between these two measurements.

1.4 The use of supporting materials on the underside of the test specimen has the ability to lower the flame spread index from those which might be

obtained if the specimen could be tested without such support. These test results do not necessarily relate to indices obtained by testing materials without such support.

1.5 Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed, results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of the standard.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This simply recognizes what the fire test labs have been doing for many years. When they conduct the "extended ASTM E84 test" they assess two criteria: a flame spread index of 25 and a flame front that does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners.

RB255-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal for several reasons. The proposal has a lower safety standard. There was a debate on the technical justification in testing. The standard in the reason statement, ASTM E05, is not referenced in the ICC. (Vote: 11-0)

Assembly Action: **None**

RB255-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R802.1.5

Proponents:

Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less. In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minutes and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the ~~extended 30-minute test~~.

Commenter's Reason: Wording approved by IBC S committee in S166. This is also consistent with what was approved in NFPA 703.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change proposal simply recognizes what the fire test labs have been doing for many years. When they conduct the "extended ASTM E84 test" they assess two criteria: a flame spread index of 25 and a flame front that does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners.

Public Comment# 1182

Public Comment 2:

IRC@: R802.1.5

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less .In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minutes and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the ~~extended 30-minute~~ test.

Commenter's Reason: This public comment will bring the language of IRC Section R802.1.5 into consistency with the language of IBC Section 2303.2, as approved under S166-19 at the Committee Action Hearings. It cleans up and simplifies the language of R802.1.5, while making it more consistent with the referenced test methods.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction There is no change in the cost of construction because the public comment simply will bring the language of IRC Section R802.1.5 into consistency with the language of IBC Section 2303.2, as approved under S166-19 at the Committee Action Hearings

Public Comment# 1698

Public Comment 3:

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests Disapprove

Commenter's Reason: We feel this lessons the life safety aspect of the code and should be maintained. The committee agreed unanimously.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1676

RB256-19

IRC@: R802.1.5.2

Proposed Change as Submitted

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R802.1.5.2 Other means during manufacture. For wood products ~~produced~~ impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coatings, stains or other surface treatments is not an approved method of protection as required in this section.

Reason: This proposal corrects the language of the section by making it identical to the language of the corresponding section of the IBC. The proposal makes two changes:

1. It incorporates the words "impregnated with chemicals" into the first sentence, which makes it consistent with the code section above that says that the pressure treatment process must provide impregnation with chemicals.

2. It adds a sentence pointing out that coatings are not permitted as a way of generating fire retardant treated wood.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This is clarification, consistent with the IBC and with the section above.

RB256-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee disapproved this proposal for several reasons. The concern was with the new last sentence. This issue is better addressed in commentary. Other products that are developed in the future should be permitted. This statement could be read to over ride evaluation service reports. The addition of "impregnated with chemicals" would better language that is consistent with other areas of the code. (Vote: 6-5)

Assembly Action:

None

RB256-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R802.1.5.2

Proponents:

Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R802.1.5.2 Other means during manufacture. For wood products impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of Wood products treated with paints, coatings, stains or other surface treatments shall not be considered fire-retardant

~~treated wood is not an approved method of protection as required in this section.~~

Commenter's Reason: This public comment revises the existing code section by adding a sentence clarifying that surface treatments (including paints and coatings) do not represent a way of generating fire-retardant treated wood. This is consistent with the original proposal but revises the sentence to react to the committee statement that the original sentence appears to be more information than a requirement. The language in the original proposal was the same as the language in IBC now. It is essential to point out that paints, coatings, stains or other surface treatments are not means to "impregnate" a wood product as they are surface treatments.

The committee stated that "Any Other products that are developed in the future should be permitted." Neither the original language nor the revised language for the existing code section prevents any product, by whatever means it is manufactured, from being considered "fire retardant treated wood" as long as it complies with all the requirements in the charging paragraph, the critical one being that the new product must be "impregnated with chemicals" and "surface treatments" are, by definition, different from "impregnation".

The committee also stated that "This statement could be read to over ride evaluation service reports." There should be no evaluation reports that identify coated products as "impregnated" products and, therefore, this sentence is basically just clarification.

Finally, the committee stated that "The addition of "impregnated with chemicals" would be language that is consistent with other areas of the code. However, the charging section already states that these products must be impregnated with chemicals, and this is, therefore, consistent with the remainder of the code.

In summary, the public comment introduces a new sentence that clarifies, in proper mandatory language, that surface treatments, such as coatings, shall not be used to create fire-retardant treated wood, and the reason is that surface treatments do not "impregnate" the wood.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The added sentence is clarification only, consistent with the charging paragraph, because this section is often misunderstood.

Public Comment# 1413

Public Comment 2:

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com); Joseph Holland, representing Hoover Treated Wood Products (jholland@frtw.com)

requests As Submitted

Commenter's Reason: This change would adopt language already in the IBC and thus make it more consistent.

Code requirements were established for only products produced using a pressure process. Testing performed using E-84 tunnel shows that coated products when tested with an 1/8" gap the length of the tunnel will not pass the test while pressure impregnated products do. The 1/8" gap is more representative of how the product will be used in the field.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. It is making the code more consistent.

Public Comment# 1677

Public Comment 3:

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests Disapprove

Commenter's Reason: The AWC supports the committee action for DISAPPROVAL. At the Committee Action Hearings, the Committee had concerns that the proposed new sentence at the end of R802.1.5.2 could be interpreted as overriding evaluation service reports. AWC agrees with the Committee recommendation for disapproval. Surface treatments such as paints, coatings and stains are more appropriately addressed through Section R104.11, which deals with alternative materials, design and methods of construction and equipment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1674

RB257-19

IRC@: R802.1.5.2

Proposed Change as Submitted

Proponents: Manny Muniz, representing Representing self (Mannymuniz.mm@gmail.com)

2018 International Residential Code

Revise as follows:

R802.1.5.2 Other means during manufacture. For wood products ~~produced~~ impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coating, stains or other surface treatments is not an approved method of protection as required by this section.

Reason: The proposed code language has already been approved in the IBC and appears in the 2018 International Building Code, Section 2303.2.2. Clarification is made that regardless of the other means used during manufacture, fire-retardant-treated wood must be impregnated with chemicals per the definition of fire-retardant-treated wood in Chapter 2. During the IBC committee hearings, the State Fire Marshal of California, a committee member, identified this code change as being a necessary clarification as California had experienced numerous problems with coated wood products pretending to be fire-retardant-treated wood. The language in the last sentence was derived from the California codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The code change simply clarifies what is not an approved method of protection as required by this section.

RB257-19

Public Hearing Results

Errata: This proposal includes unpublished errata. The cost impact statement should read as follows:

Cost impact: The code change proposal will not increase or decrease the cost of construction. The code change simply clarifies what is not an approved method of protection as required by this section.

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved for consistency with the committee action on RB257. (Vote: 7-4)

Assembly Action:

None

RB257-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Submitted

Commenter's Reason: This change would adopt language already in the IBC and thus make it more consistent.

Code requirements were established for only products produced using a pressure process. Testing performed using E-84 tunnel shows that coated products when tested with an 1/8" gap the length of the tunnel will not pass the test while pressure impregnated products do. The 1/8" gap is more representative of how the product will be used in the field.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Makes the code more consistent.

Public Comment# 1679

Public Comment 2:

Proponents:

Manny Muniz, representing Representing self (mannymuniz.mm@gmail.com)

requests As Submitted

Commenter's Reason: The proposed code language has already been vetted in the IBC and now appears in the 2018 International Building Code, Section 2303.2.2. Clarification is made that regardless of the other means used during manufacture, fire-retardant-treated wood must be impregnated with chemicals per the definition of fire-retardant-treated wood in Chapter 2. During the 2018 IBC committee hearings, the State Fire Marshal of California, a committee member, identified this code change as being a necessary clarification as California had experienced numerous problems with coated wood products pretending to be fire-retardant-treated wood. The language in the last sentence was derived from the California codes.

There is considerable confusion regarding the use of paints, coatings, stains or other surface treatments for fire-protection purposes on the exterior of a structure. Such a product is not regulated by the International Building Code or the International Fire Code and there are no nationally recognized standards for such products.

NFPA 703 (*"Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials"*) Chapter 5 Fire-Retardant Coatings for Building Materials only applies to fire-retardant paints and other surface coatings applied to building materials **used for interior finish** to reduce flame spread or smoke development or both (5.1). NFPA 703 is referenced in Section 803.4 of the International Fire Code.

In the NIST research report "**Effect of Fire-Retardant Coatings and Weathering on the Flammability of Wood-Based Materials in WUI Communities**", the conclusion was that commercial FR coatings are only good for a few weeks and that FR coatings + top-coating are only good for a few months.

The committee reason for disapproval is puzzling. *"There has been no history of failure of tests for fire retardant treated wood. This could be an undue burden on manufacturers."* What relevance is there that *"There has been no history of failure of tests for fire retardant treated wood"* given the fact that the definition of fire-retardant-treated wood in Chapter 2 requires that it be impregnated with chemicals. How could this be an undue burden on manufacturers of fire-retardant-treated wood?

Chapter 2, Definitions

Treated Wood

"Fire-retardant-treated wood. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire."

Bibliography: The 2018 International Building Code; the 2016 California Building Code; the 2019 California Building Code; and the NIST Report - Effect of Fire-Retardant Coatings and Weathering on the Flammability of Wood-Based Materials in WUI Communities
https://www.nist.gov/sites/default/files/documents/2019/06/03/laura_dubrulle_bcc_2019_final.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The amendment to the first sentence is derived from the Chapter two definition for fire-retardant-treated wood and is intended for clarity. The addition of the last sentence simply clarifies what is not an approved method of protection as required by this section and correlates with the same clarification already established in IBC 2303.2.2. As such, the cost of construction will not increase or decrease.

Public Comment# 1879

RB258-19

IRC: R802.1.5.3, 802.1.5.3.1 (New)

Proposed Change as Submitted

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R802.1.5.3 Testing. For ~~wood products produced by other means during manufacture, other than a pressure process, all sides fire retardant treated wood products~~ the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5. ~~Testing of only the front and back faces of wood structural panels shall be permitted.~~

Add new text as follows:

R802.1.5.3.1 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).

Reason: Note that the sections above require that fire retardant treated wood be "impregnated with chemicals" and provide permanent protection. That requirement applies to all FRTW products, whether produced by a pressure process or produced by other means during manufacture. IBC Section 2303.2.2 (and the proposed revision to R802.1.5.2, for consistency) is also explicit in stating that the use of paints or coatings is not an approved method to comply with this section. This proposal thus eliminates the requirement to test a particular type of fire retardant treated wood on "all sides", since the testing is never actually conducted on all sides (as pointed out often by multiple testifiers in previous code cycles) because all sides really means front and back (you literally cannot test the edges in the ASTM E84 other than by putting multiple edge pieces into the tunnel to make up the 24 feet by 2 feet specimen). In order to test "all sides" of a lumber product it would be necessary to fasten 864 small pieces together to make one specimen, which is not realistic.

The proposed new subsection will add fire safety because it recognizes an issue that was highlighted in the previous code cycle, and was also brought up in committee ASTM E05 and at the IWUIC: wood structural panels are typically installed in the field following industry practice. Industry recommendations for wood structural panels require a gap to accommodate dimensional changes caused by swelling due to changing moisture conditions. Therefore, installation in the field requires cutting and ripping of the panels and this results in the creation of "non-factory edges". Therefore, it is important to test wood structural panels with a rip or gap to ensure that the required fire test results from the charging paragraph are achieved when the interior of the panel is exposed.

Note that the IWUIC requires such a rip or gap for ignition resistant structural panels, and it sends FRTW products to IBC section 2303.2, which is equivalent to section R802.1.5.

Cost Impact: The code change proposal will increase the cost of construction

This proposal will add fire safety and will require more testing for wood structural panels. The proposal will also require more testing for other FRTW products manufactured by a pressure process but apparently less testing for FRTW products that are manufactured by other means, except that typically just the front and back faces are tested anyway.

RB258-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee disapproved this proposal for several reasons. There has been no history of failure of tests for fire retardant treated wood. This could be an undue burden on manufacturers. (Vote: 11-0)

Assembly Action:

None

RB258-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R802.1.5.3, R802.1.5.3.1 (New)

Proponents:

Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R802.1.5.3 Testing.** For fire retardant treated wood products the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5.~~

~~**R802.1.5.3.1 Fire testing of wood structural panels.** Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).~~

Commenter's Reason: This public comment recommends deleting the entire section, including the added revised wording. This would make it consistent with the action taken by the IBC S committee and eliminates both the requirement for excessive unnecessary testing (including the discrimination based on the means of manufacture) and the proposed new added requirement to test panels with a rip or gap. ASTM is working on considering testing for panels and the inclusion in codes is premature at this point.

Note that the original proposal increased testing for pressure-treated FRTW products and decreased testing for other FRTW products, while the PC lower everyone's testing burden, reducing costs and creating a level playing field for all FRTW products.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The public comment will decrease the amount of unnecessary fire testing of one particular type of fire-retardant treated wood as compared to other types of fire-retardant treated wood, when the only difference is the manufacturing process. The public comment recognizes that the added testing required by this section has no effect on fire safety.

Public Comment# 1187

Public Comment 2:

IRC@: R802.1.5.3, R802.1.5.3.1 (New)

Proponents:

David Tyree, representing American Wood Council (dtyree@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R802.1.5.3 Testing.** For fire retardant treated wood products the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5.~~

~~**R802.1.5.3.1 Fire testing of wood structural panels.** Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).~~

Commenter's Reason: This public comment will bring the language of IRC Section R802.1.5.3 into consistency with the language of IBC Section 2303.2.3, as approved under S167-19 at the Committee Action Hearings. Section R802.1.5 already addresses testing and performance requirements for FRTW produced either by a pressure process or by other means during manufacture, so the testing provisions of Section R802.1.5.3 are redundant and unnecessary. Furthermore, the fact that Section R802.1.5.3 is applicable only to FRTW produced by other means during manufacture creates a potential for double-standards when compared to the requirements for FRTW produced by a pressure process. Deletion of R802.1.5.3 will remove these redundant provisions and help to ensure a 'level playing field' between FRTW product types. With regards to the proposed new Section R802.1.5.3.1, we agree with the Committee in their assessment that the proposed provision requiring a 1/8" longitudinal gap 'could be an undue burden on manufacturers.' Specific provisions regarding testing should be addressed in the applicable consensus-based test standard, rather than in the code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This public comment will bring the language of IRC Section R802.1.5.3 into consistency with the language of IBC Section 2303.2.3, as approved under S167-19 at the Committee Action Hearings so no increase or decrease of construction costs.

RB261-19

IRC: R802.5.2, TABLE R802.5.2, R802.5.2.1, R802.5.2.2, R802.5.2.3

Proposed Change as Submitted

Proponents: Randy Shackelford, P.E., Simpson Strong-Tie Co., representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

2018 International Residential Code

Add new text as follows:

R802.5.2 Ceiling joist and rafter connections. Ceiling joists, rafter ties and ridge beams shall be in accordance with Sections R802.5.2.1 and R802.5.2.2.

Revise as follows:

R802.5.2 R802.5.2.1 Ceiling joist and rafter connections: joists parallel to rafters. Where ceiling joists run parallel to rafters and are located at the top wall plate, they shall be connected to rafters ~~at and~~ the top wall plate in accordance with Table ~~R802.5.2~~ R802.5.2.1. Where ceiling joists are not connected to the rafters at the top wall plate, they shall be installed in the bottom third of the rafter height in accordance with Figure R802.4.5 and Table ~~R802.5.2~~ R802.5.2.1. Where the ceiling joists are installed above the bottom third of the rafter height, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice as a beam. ~~Where ceiling joists do not run parallel to rafters, the ceiling joists shall be connected to top plates in accordance with Table R602.3(1). Each rafter shall be tied across the structure with a rafter tie or a 2-inch by 4-inch (51 mm x 102 mm) kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2.~~

**TABLE R802.5.2 R802.5.2.1
 RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS^{a, b, c, d, e, g}**

Portions of table not shown remain unchanged.

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)															
		20 ^f				30				50				70			
		Roof span (feet)															
		12	20	28	36	12	20	28	36	12	20	28	36	12	20	28	36
		Required number of 16d common nails ^{a, b} per heel joint splices ^{c, d, e}															

Add new text as follows:

R802.5.2.2 Ceiling joists not parallel to rafters or not provided. Where ceiling joists do not run parallel to rafters, the ceiling joists shall be connected to top plates in accordance with Table R602.3(1). Each rafter shall be tied across the structure with a rafter tie not less than 2 inches by 4 inches (51 mm x 102 mm) fastened to rafters in accordance with Table R802.2.5.1 and with joints in accordance with Section R802.5.3. Where ceiling joists or rafter ties are not provided, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice.

Revise as follows:

R802.5.2.1 R802.5.3 Ceiling joists lapped. Ends of ceiling joists shall be lapped not less than 3 inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. Where ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together in accordance with Table R802.5.2 and butted joists shall be tied together with a connection of equivalent capacity in a manner to resist such thrust. Joists that do not resist thrust shall be permitted to be nailed in accordance with Table R602.3(1). ~~Wood structural panel roof sheathing, in accordance with Table R503.2.1.1(1), shall not cantilever more than 9 inches (229 mm) beyond the gable endwall unless supported by gable overhang framing.~~

Delete without substitution:

R802.5.2.2 Rafter ties. ~~Wood rafter ties shall be not less than 2 inches by 4 inches (51 mm x 102 mm) installed in accordance with Table R802.5.2 at each rafter. Other approved rafter tie methods shall be permitted.~~

Revise as follows:

R802.5.2.3 R802.5.4 Blocking- Lumber. ~~Blocking- Lumber used to transfer loads shall be not less than utility grade lumber.~~

Reason: The purpose of this code change is to clarify the requirements for connections of rafters and ceiling joists. This section is the most important section in establishing the concept of the continuous tie across the lower portion of the rafters, using either ceiling joists or rafter ties, which will prevent the rafters from sliding off the walls or pushing the walls out when the rafters are loaded, which is referred to as rafter thrust. The concept is that the ceiling joists have to be installed in the lower portion of the attic, and fastened in a specific manner as required in Table R802.5.2. However, sometimes the ceiling joists are installed higher in the attic where they are ineffective as a tie, sometimes the ceiling joists are installed perpendicular to the rafters, and sometimes there may not be any ceiling joists at all, such as in a cathedral ceiling.

So the first revision is to break out these possibilities into two separate sections to clarify what needs to happen in each case to ensure the rafters do not slide off the walls or push them outward.

In each case, either a tie can be provided, or a "wall or ridge beam designed in accordance with accepted engineering practice" can be provided. This language is close to what was required in this section prior to the 2018 edition.

In new R802.5.2.2, the requirements for rafter ties are moved back into this section, and the description of the rafter tie is provided. Since it is in this section now, the subsequent section on Rafter Ties can be deleted. The language about the kicker connected to the ceiling diaphragm is deleted because I don't know what a kicker really is in regard to ceiling joists, and because a prescriptive requirement is not provided. Any alternate method could be accepted if proven equivalent.

In new R802.5.3, Ceiling Joists Lapped, the last sentence talking about wood structural panel roof sheathing is deleted because this is out of place. The exact same wording is repeated in Section R803.2.3, which is the appropriate location.

In the last section, the term "blocking" was replaced by "lumber". It does not appear that the term "blocking" is used anywhere in this section, but it is possible that scraps of wood could be used to transfer tension loads across butt joints in ceiling joists or rafter ties, so it is proposed to be left in this way.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. There is no intent to cause any change in requirements, just a clarification.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal is generally a good idea, but it would inappropriately remove the option for kickers in attics. Section R802.5.3 clarifies butted joist connections, but it is not clear how to determine equivalent capacity. (Vote: 10-1)

Assembly Action:

None

RB261-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R802.3, R802.5, R802.5.2, R802.5.2.1, R802.5.2.2, R802.5.2.3

Proponents:

Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R802.3 Ridge. A ridge board used to connect opposing rafters shall be not less than 1 inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. Where ceiling joist or rafter ties do not provide continuous ties across the structure as required by Section R802.5.2, the a-ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice shall be provided and supported on each end by a wall or column girder.

R802.5 Ceiling joists. Ceiling joists shall be continuous across the structure or securely joined where they meet over interior partitions in accordance with ~~Table R802.5.2~~ Section R802.5.2.1. Ceiling joists shall be fastened to the top plate in accordance with Table R602.3(1).

R802.5.2 Ceiling joist and rafter connections. Where ceiling joists run parallel to rafters, and they are located they shall be connected to rafters at the top wall plate in accordance with Table R802.5.2. Where ceiling joists are not connected to the rafters at the top wall plate, they shall be installed in the bottom third of the rafter height, they shall be installed in accordance with Figure R802.4.5 and fastened to rafters in accordance with Table R802.5.2. Where the ceiling joists are installed above the bottom third of the rafter height, the ridge shall be designed as a beam in accordance with R802.3. Where ceiling joists do not run parallel to rafters, the ceiling joists shall be connected to top plates in accordance with Table R602.3(1). Each rafter s shall be tied across the structure with a rafter tie in accordance with R802.5.2.2, or the ridge shall be designed as a beam in accordance with R802.3, or a 2-inch by 4-inch (51 mm x 102 mm) kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2.

R802.5.2.1 Ceiling joists lapped. Ends of ceiling joists shall be lapped not less than 3 inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. Where ceiling joists are used to provide the continuous tie across the building resistance to rafter thrust, lapped joists shall be nailed together in accordance with Table R802.5.2 and butted joists shall be tied together with a connection of equivalent capacity in a manner to resist such thrust. Laps in joists Joists that do not resist thrust provide the continuous tie across the building shall be permitted to be nailed in accordance with Table R602.3(1). Wood structural panel roof sheathing, in accordance with Table R503.2.1.1(1), shall not cantilever more than 9 inches (229 mm) beyond the gable endwall unless supported by gable overhang framing.

R802.5.2.2 Rafter ties. Wood rafter ties shall be not less than 2 inches by 4 inches (51 mm x 102 mm) installed in accordance with Table R802.5.2 at each rafter a maximum of 24" o.c. Other approved rafter tie methods shall be permitted.

R802.5.2.3 Blocking. Blocking shall be not less than utility grade lumber.

Commenter's Reason: The purpose of this code change is to clarify the requirements for connections of rafters and ceiling joists and specify when ridge beams are required. This section describes how to construct a rafter/ceiling joist system so that the rafters do not slide down under loads and push out the exterior bearing walls, which is called rafter thrust. The concept is that the rafters and ceiling joist form a triangle, which is a stable shape that will not change its shape as long as the ends of the three members are connected together. When the lower ends of the rafters are not tied back to resist thrust, the only way to prevent thrust is to support them at the peak by a ridge beam.

The original proposal added new sections and deleted existing sections. This revised proposal keeps the existing sections and just makes changes within them.

R802.3: This section on ridges is revised to bring language from older versions of the IRC about "ridge beam designed in accordance with engineering practice" in the current IRC. Also since the ridge is supporting half the weight of the rafters now, it would have to be supported on each end. It seems like a ridge beam is more likely to be supported by a column than a girder.

R802.5: Ceiling joists need their laps to be in accordance with Section R802.5.2.1, not Table R802.5.2. Where joists provide the continuous tie, then yes the laps do need to be fastened together per Table R802.5.2. But if the joists are not providing the tie, the laps can be fastened per Table R602.3(1). Also moved the requirement for fastening the ceiling joists to the top plate to this section, since that is the same regardless of which direction the ceiling joists run.

R802.5.2: There are really four cases that need to be considered: 1. Ceiling joists parallel to rafters and located at the top plate; 2. Ceiling joists parallel to rafters and located in the bottom third of the roof height; 3. Ceiling joists parallel to rafters and NOT located in the bottom third of the roof height; and 4. Ceiling joists perpendicular to rafters. This proposal keeps these all in one section, but combines the first two since the requirements are the same for both cases. Where the ceiling joists are parallel to the rafters but installed in the upper two-thirds of the roof, it is assumed that there would not be a rafter tie across the lower portion of the rafters, because it would be visible below the ceiling, so the only option given is a ridge beam. Where the joists run perpendicular to the rafters, either a rafter tie can be provided above the joists, or a ridge beam could be provided. The portion of the last sentence referring to a "2" by 4" kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2" is deleted for several reasons. This is not a prescriptive requirement and there is no assurance that the conventional ceiling diaphragm will have the strength to resist these forces. Also I believe there was some thought by members of the IRC-Building Committee that this was an effort to prohibit rafter braces and purlins. That is not the case. Rafter braces and purlins are covered in Section R802.4.5 and would still be permitted if this code change were approved. Further, removing this sentence in R802.5.2 can be seen as removing a conflict with the purlin/brace requirements of Section R802.4.5, since that section requires that braces be supported by bearing walls, not just a ceiling. Also note that footnote d of Table R802.5.2 allows a reduction in the ceiling joist to rafter connections if braces are provided, but does not eliminate the need for these connections overall.

R802.5.2.1: This clarifies the two cases where the ceiling joists are or are not providing the continuous tie across the building and specifies which table to use for fastening the lap splices for each case. Also, the last sentence is deleted since this does not belong here, and is repeated in Section R803.2.3.

R802.5.2.2: Spacing of rafter ties is clarified. Since Table R802.5.2 only gives fastening for rafter spacing of 12, 16, and 24" on center, the spacing of the rafter ties has to be a maximum of 24" o.c. But if rafters were spaced at 12" o.c., the ties would not have to be installed at every rafter, just at a maximum of 24" o.c.

R802.5.2.3: The original proposal revised this section to apply to "lumber used to transfer loads" rather than blocking. There was some concern from the wood industry that utility grade lumber might not be adequate to transfer loads. So it is proposed to make no changes to this section in the Public Comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The Public Comment is meant to be editorial clarification only. There is no intent to change the requirements.

Public Comment# 2107

RB262-19

IRC@: TABLE R802.5.2

Proposed Change as Submitted

Proponents: Dennis Richardson, American Wood Council, representing American Wood Council (drichardson@awc.org)

2018 International Residential Code

Delete and substitute as follows:

TABLE R802.5.2
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS^{a, b, c, d, e, f}

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)															
		20 ^f				30				50				70			
		Roof span (feet)															
		12	20	28	36	12	20	28	36	12	20	28	36	12	20	28	36
		Required number of 16d common nails ^{a, b} per heel joint splices ^{c, d, e}															
3:12	12	4	6	8	10	4	6	8	11	5	8	12	15	6	11	15	20
	16	5	8	10	13	5	8	11	14	6	11	15	20	8	14	20	26
	24	7	11	15	19	7	11	16	21	9	16	23	30	12	21	30	39
4:12	12	3	5	6	8	3	5	6	8	4	6	9	11	5	8	12	15
	16	4	6	8	10	4	6	8	11	5	8	12	15	6	11	15	20
	24	5	8	12	15	5	9	12	16	7	12	17	22	9	16	23	29
5:12	12	3	4	5	6	3	4	5	7	3	5	7	9	4	7	9	12
	16	3	5	6	8	3	5	7	9	4	7	9	12	5	9	12	16
	24	4	7	9	12	4	7	10	13	6	10	14	18	7	13	18	23
7:12	12	3	4	4	5	3	3	4	5	3	4	5	7	3	5	7	9
	16	3	4	5	6	3	4	5	6	3	5	7	9	4	6	9	11
	24	3	5	7	9	3	5	7	9	4	7	10	13	5	9	13	17
9:12	12	3	3	4	4	3	3	3	4	3	3	4	5	3	4	5	7
	16	3	4	4	5	3	3	4	5	3	4	5	7	3	5	7	9
	24	3	4	6	7	3	4	6	7	3	6	8	10	4	7	10	13
12:12	12	3	3	3	3	3	3	3	3	3	3	3	4	3	3	4	5
	16	3	3	4	4	3	3	3	4	3	3	4	5	3	4	5	7
	24	3	4	4	5	3	3	4	6	3	4	6	8	3	6	8	10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. 40d box nails shall be permitted to be substituted for 16d common nails.
- b. Nailing requirements shall be permitted to be reduced 25 percent if nails are clinched.
- c. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.
- d. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.
- e. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
- f. Applies to roof live load of 20 psf or less.
- g. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_G/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_G = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

**TABLE R802.5.2
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS^a**

SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)											
		20 ^e			30			50			70		
		Roof span (feet)											
		12	24	36	12	24	36	12	24	36	12	24	36
		Required number of 16d common nails per heel joint splice ^{a,b,c,d,f}											
3:12	12	3	5	8	3	6	9	5	9	13	6	12	17
	16	4	7	10	4	8	12	6	12	17	8	15	23
	19.2	4	8	12	5	10	14	7	14	21	9	18	27
	24	5	10	15	6	12	18	9	17	26	12	23	34
4:12	12	3	4	6	3	5	7	4	7	10	5	9	13
	16	3	5	8	3	6	9	5	9	13	6	12	17
	19.2	3	6	9	4	7	11	6	11	16	7	14	21
	24	4	8	11	5	9	13	7	13	19	9	17	26
5:12	12	3	3	5	3	4	6	3	6	8	4	7	11
	16	3	4	6	3	5	7	4	7	11	5	9	14
	19.2	3	5	7	3	6	9	5	9	13	6	11	17
	24	3	6	9	4	7	11	6	11	16	7	14	21
7:12	12	3	3	4	3	3	4	3	4	6	3	5	8
	16	3	3	5	3	4	5	3	5	8	4	7	10
	19.2	3	4	5	3	4	6	3	6	9	4	8	12
	24	3	5	7	3	5	8	4	8	11	5	10	15
9:12	12	3	3	3	3	3	3	3	3	5	3	4	6
	16	3	3	4	3	3	4	3	4	6	3	5	8
	19.2	3	3	4	3	4	5	3	5	7	3	6	9
	24	3	4	5	3	4	6	3	6	9	4	8	12
12:12	12	3	3	3	3	3	3	3	3	4	3	3	5
	16	3	3	3	3	3	3	3	3	5	3	4	6
	19.2	3	3	3	3	3	4	3	4	6	3	5	7
	24	3	3	4	3	3	5	3	5	7	3	6	9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. 10d common (3" x 0.148") nails shall be permitted to be substituted for 16d common (3-1/2" x 0.162") nails where the required number of nails is taken as 1.2 times the required number of 16d common nails.

b. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

e. Applies to roof live load of 20 psf or less.

f. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

g. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

Reason: Replace Table R802.5.2 to be consistent with calculation basis of 2018 Wood Frame Construction Manual (WFCM) heel joint nailing requirements based on the 2018 National Design Specification for Wood Construction (NDS) provisions for nailed connections. The reduced number of 16d common nails required in rafter tie connections, by approximately 15%, are due to changes in penetration factor and load duration assumptions from those used to develop the existing table. The existing table used a 0.77 penetration factor (based on 1991 and 1997 NDS) for 16d common nails with less than 12d penetration in the main member and a load duration factor of 1.25 for all tabulated cells. The proposed revised nailing requirements are based on use of a 1.15 load duration factor for snow cases, 1.25 load duration factor for roof live load cases, and an effective penetration factor equal to 1.0 per 2001 NDS and later editions when nail lateral value calculations are based on the actual penetration in the wood member. The ratio of nail design values for snow cases originally used to develop nailing requirements to the current nail design values for snow cases is $(Z \times 0.77 \times 1.25) / (Z \times 1.0 \times 1.15) = 0.84$ and explains the reduced number of nails required by this proposal. Due to revised nail design provisions in the NDS, the benefit of a longer nail that is clinched is no longer recognized for this application and existing footnote b is removed. A 10d common nail option is added in new footnote "a." based on NDS lateral nail calculations. The table heading clarifies the 10psf dead load basis of the tabulated nailing requirements.

Bibliography: 1) 2018 Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings. American Wood Council, Leesburg, VA. 2018. <https://awc.org/pdf/codes-standards/publications/wfcm/AWC-WFCM2018-ViewOnly-1711.pdf>
 2) 2018 National Design Specification (NDS) for Wood Construction. American Wood Council, Leesburg, VA. 2018. <https://awc.org/pdf/codes-standards/publications/nds/AWC-NDS2018-ViewOnly-171117.pdf>

Cost Impact: The code change proposal will decrease the cost of construction
 This code change utilizes fewer nails from the WFCM at less cost.

RB262-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The committee approved this proposal because it is coordinated with the 2018 Wood Frame Construction Manual and the National Design Specifications for Wood Construction. The proposal also added center spacing for joist heels. (Vote: 10-0)

Assembly Action:

None

RB262-19

Individual Consideration Agenda

Public Comment 1:

IRC@: TABLE R802.5.2

Proponents:

Paul Coats, representing American Wood Council (pcoats@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**TABLE R802.5.2
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS ⁹**

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)											
		20 ^e			30			50			70		
		Roof span (feet)											
		12	24	36	12	24	36	12	24	36	12	24	36
		Required number of 16d common nails per heel joint splice ^{a,b,c,d,f}											
3:12	12	3	5	8	3	6	9	5	9	13	6	12	17
	16	4	7	10	4	8	12	6	12	17	8	15	23
	19.2	4	8	12	5	10	14	7	14	21	9	18	27
	24	5	10	15	6	12	18	9	17	26	12	23	34
4:12	12	3	4	6	3	5	7	4	7	10	5	9	13
	16	3	5	8	3	6	9	5	9	13	6	12	17
	19.2	3	6	9	4	7	11	6	11	16	7	14	21
	24	4	8	11	5	9	13	7	13	19	9	17	26
5:12	12	3	3	5	3	4	6	3	6	8	4	7	11
	16	3	4	6	3	5	7	4	7	11	5	9	14
	19.2	3	5	7	3	6	9	5	9	13	6	11	17
	24	3	6	9	4	7	11	6	11	16	7	14	21
7:12	12	3	3	4	3	3	4	3	4	6	3	5	8
	16	3	3	5	3	4	5	3	5	8	4	7	10
	19.2	3	4	5	3	4	6	3	6	9	4	8	12
	24	3	5	7	3	5	8	4	8	11	5	10	15
9:12	12	3	3	3	3	3	3	3	3	5	3	4	6
	16	3	3	4	3	3	4	3	4	6	3	5	8
	19.2	3	3	4	3	4	5	3	5	7	3	6	9
	24	3	4	5	3	4	6	3	6	9	4	8	12
12:12	12	3	3	3	3	3	3	3	3	4	3	3	5
	16	3	3	3	3	3	3	3	3	5	3	4	6
	19.2	3	3	3	3	3	4	3	4	6	3	5	7
	24	3	3	4	3	3	5	3	5	7	3	6	9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. 10d common (3" x 0.148") nails shall be permitted to be substituted for 16d common (3-1/2" x 0.162") nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.

b. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

e. Applies to roof live load of 20 psf or less.

f. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically ~~above~~ from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties.

H_R = Height of roof ridge measured vertically ~~above~~ from the top of the rafter support walls to the bottom of the roof ridge.

Where H_C / H_R exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

g. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

Commenter's Reason: This table replacement was also proposed for the IBC in code change S187-19, and there the Structural Committee made specific suggestions on S187-19 to clarify applicability of the new table. Those suggestions for improvement are reflected in this public comment for the parallel IRC table. If this public comment and the one to S187-19 are approved, the new tables will be more consistent, though there will still be some minor format differences.

In this public comment: 1) text is added to footnote "a" to clarify that results should be rounded to the next full nail; 2) a sentence is added beneath the table in footnote "f" to clarify that rafter tie connections higher than $H_C / H_R = 1/3$ in the attic space must be engineered; and 3) the definitions of H_C and H_R in footnote "f" are clarified to show how they should be measured.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The public comment only clarifies the intent of the original proposal, so no additional cost impact.

Public Comment# 1852

RB272-19

IRC: R904 (New), R905.2.4.1, TABLE R905.2.4.1, R905.1, R905.16.6, R905.17.7, ASTM, FM, ICC, UL Chapter 44 (New)

Proposed Change as Submitted

Proponents: T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

2018 International Residential Code

Add new text as follows:

SECTION R904 **WIND REQUIREMENTS FOR ROOF COVERINGS**

R904.1 Wind resistance for roof coverings. Roof coverings shall comply with the wind provisions and limitations of this section.

Revise as follows:

~~R905.2.4.1~~ **R904.1.1 Wind resistance of asphalt shingles.** Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table ~~R905.2.4.1~~ R904.1.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table ~~R905.2.4.1~~ R904.1.1.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table ~~R905.2.4.1~~ R904.1.1.

**TABLE R905.2-4-1 R904.1.1
CLASSIFICATION OF ASPHALT ROOF SHINGLES**

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} FROM FIGURE R301.2(5)A (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3(mph)	ASTM D7158^aSHINGLE CLASSIFICATION	ASTM D3161SHINGLE CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and a building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

Add new text as follows:

R904.1.2 Concrete and clay tile. In regions where wind design is required in accordance with Figure R301.2(5)B, wind loads on concrete and clay tile shall be determined in accordance with Section 1609.5 of the *International Building Code*. Concrete and clay tile shall be tested to determine their resistance to overturning due to wind loads in accordance with SBCCI SSTD 11 or ASTM C1568. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 of the *International Building Code* for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11.

In regions where wind design is not required in accordance with Figure R301.2(5)B, concrete and clay tiles shall be attached in accordance with this section or Section R905.3

R904.1.3 Metal roof shingles. Metal roof shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof shingles shall be tested in accordance with FM 4474, UL 580 or UL 1897.

R904.1.4 Mineral-surfaced roll roofing. Mineral-surfaced roll roofing shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R904.1.5 Slate shingles. Slate shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R904.1.6 Wood shingles. In regions where wind design is required in accordance with Figure R301.2(5)B, Wood shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). In regions where wind design is not required in accordance with Figure R301.2(5)B, wood shingles are permitted to be attached in accordance with Section R905.7.

R904.1.7 Wood shakes. In regions where wind design is required in accordance with Figure R301.2(5)B, Wood shakes shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). In regions where wind design is not required in accordance with Figure R301.2(5)B, wood shakes are permitted to be attached in accordance with Section R905.8.

R904.1.8 Metal roof panels. Metal roof panels shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof panels shall be tested for wind resistance in accordance with FM 4474, UL 580, or UL 1897.

R904.1.9 Photovoltaic shingles. Photovoltaic shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic shingles shall comply with the classification requirements of Table R904.1.1 for the appropriate maximum basic wind speed. Photovoltaic shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from Table R904.1.1.

R904.1.10 Building-integrated Photovoltaic roof panels. BIPV roof panels shall be tested in accordance with UL 1897. BIPV roof panel packaging shall bear a label to indicate compliance with UL 1897.

R904.1.11 Other roof systems. ~~Built-up, modified bitumen, fully adhered or mechanically attached single ply systems, sprayed polyurethane foam, and liquid applied roof coverings shall be tested in accordance with FM 4474, UL1897 or UL 580 and installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).~~

Revise as follows:

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. ~~Unless otherwise specified in this section, roof Roof coverings shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3); comply with the wind requirements specified in Section R904.~~

R905.16.6 Wind resistance. ~~Photovoltaic Wind resistance of photovoltaic shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D3161. Photovoltaic shingles shall comply with the classification requirements of Table R905.2.4.1 for the appropriate maximum basic wind speed. Photovoltaic shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D3161 and the required classification from Table R905.2.4.1. Section R904.~~

R905.17.7 Wind resistance. ~~Wind resistance of BIPV roof panels shall be tested in accordance with UL 1897. BIPV roof panel packaging shall bear a label to indicate compliance with UL 1897. Section R904.~~

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

C1568-08(2013): Standard Test Method for Wind Resistance of Concrete and Clay Roof Tiles (Mechanical Uplift Resistance Method)

R904.1.2

FM

FM Approvals
Headquarters Office
Norwood MA 02062

4474-2011: American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures R904.1.3, R904.1.8

ICC

International Code Council, Inc.
500 New Jersey Avenue NW
Washington DC 20001

SBCCI SSTD 11-97: Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles R904.1.2

UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062

580-2006: Test for Uplift Resistance of Roof Assemblies-with Revisions through October 2013 R904.1.3, R904.1.8

Reason: This proposal is one of two proposals intended to clarify the wind limitations in the IRC. Section R301.2.1.1 intends to limit the applicability of the IRC to areas where wind design is not required in accordance with Figure R301.2(5)B. However, Chapter 9 contains high wind requirements for asphalt shingles and for underlayment in wind design required regions, but for no other roof coverings. While Section R905.1 states that unless otherwise specified, roof coverings have to resist the component and cladding loads specified in Table R302(2), that requirement is not necessarily correct for all roof coverings. Prescriptive attachment methods are provided for concrete and clay tile but the code does not specify any wind limitations on the use of this prescriptive method.

Therefore, a new section is proposed for Chapter 9 on roof coverings that specifically addresses the wind limitations in the IRC for roof covering attachment and specifies the performance requirements for roof coverings in wind design required regions. It is similar to and was patterned after Section 1504 in the IBC.

This proposal is not intended to change any technical requirements in the IRC related to wind design. It is intended to simply clarify the wind requirements for roof coverings in the IRC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal will not increase the cost of construction as it is primarily a clarification.

Staff Analysis: The referenced standard, ASTM C1568-08(2013), FM 4474-2011, ICC SBCCI SSTD 11-97 and UL 580-2006 are currently referenced in other 2018 I-codes.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: While the intent to clarify the wind limitations is needed, the committee found the revised language confusing. (Vote: 8-3)

Assembly Action:

None

RB272-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R904.1.3 (New), TABLE R904.1.3 (New)

Proponents:

T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R904.1.3 Metal roof shingles. ~~Metal roof shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof shingles shall be tested in accordance with FM 4474, UL 580 or UL 1897. Metal roof shingles applied to a solid or closely fitted deck shall be tested in accordance with ASTM D3161, FM 4474, UL 580, or UL 1897. Metal roof shingles tested in accordance with ASTM D3161 shall meet the classification requirements of Table R904.1.3 for the appropriate maximum basic wind speed and the metal shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table R904.1.3.~~

**TABLE R904.1.3
CLASSIFICATION OF STEEP SLOPE METAL ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161**

MAXIMUM ULTIMATE DESIGN	MAXIMUM BASIC WIND	ASTM
WIND SPEED, V_{ULT}, FROM FIGURE	SPEED, V_{ASD}, FROM TABLE	D3161 SHINGLE
R301.2(5)A (mph)	R301.2.1.3 (mph)	CLASSIFICATION
110	85	A, D, or F
116	90	A, D, or F
129	100	A, D, or F
142	110	E
155	120	E
168	130	E
181	140	E
194	150	E

Commenter's Reason: This public comment will clarify some of the confusion that occurred with the original modification. Our original modification inadvertently left out the option of using ASTM D3161 for wind resistance testing of metal roof shingles. RB279, which specifically addresses wind resistance testing of metal roof shingles was Approved as Modified by the IRC Committee. This public comment pulls the language for testing metal shingles that the IRC Committee Approved as Modified, and incorporates it within RB272. The lack of clarity on the original proposal with regard to the use of ASTM D3161 for metal shingles is resolved by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is only a clarification.

Public Comment# 1645

RB273-19

IRC@: R905.1.1, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Gregory Keeler, Owens Corning, representing Owens Corning (greg.keeler@owenscorning.com)

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869, ~~and D6757~~ and ASTM WK51913 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen *underlayment* complying with ASTM D1970 installed in accordance with both the *underlayment* manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane complying with ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An *approved underlayment* for the applicable roof covering for maximum ultimate design wind speeds, V_{ult} , less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II; ~~or~~ ASTM D4869 Type III or Type IV; or ASTM WK51913 shall be permitted to be installed as follows in 3.1 through 3.4:
 - 3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
 - 3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
 - 3.3. *Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
 - 3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $\frac{3}{4}$ inch (19 mm) into the roof sheathing.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ?????: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This is a placeholder for the ASTM Work Item to develop a standard related to synthetic underlayments. This will be the first ASTM Standard that applies specifically to synthetic underlayments and includes requirements that are related directly to synthetic underlayments. These requirements are much more appropriate for synthetic underlayment products than testing in accordance with the current standards which are specifically for asphalt impregnated products.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal simply adds requirements for products that are already in widespread use.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB273-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal was disapproved because the new proposed standard is not yet finalized. (Vote: 11-0)

Assembly Action:

None

RB273-19

Individual Consideration Agenda

Public Comment 1:

IRC@: ASTM Chapter 44 (New)

Proponents:

Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ~~2019~~ 2019:: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Commenter's Reason: The ASTM Work Item is still in process but there is a good chance that we will have a published standard prior to the FAH in October. This will establish a standard that relates directly to synthetic underlayments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal only adds a referenced standard that applies directly and specifically to synthetic underlayments. Thus, there is no cost impact.

Staff Analysis: In accordance with Section 3.6.3.1 of ICC Council Policy 28, the new referenced standard ASTM WK51913-2019, *Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing*, must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

Public Comment# 2008

RB274-19

IRC@: R905.1.1, TABLE R905.1.1(1)

Proposed Change as Submitted

Proponents: Mike Fischer, Kellen Company, representing The Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

- ~~1. As an alternative, self-adhering polymer-modified bitumen *underlayment* complying with ASTM D1970 installed in accordance with both the *underlayment* manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.~~
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane complying with ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An *approved underlayment* for the applicable roof covering for maximum ultimate design wind speeds, V_{ult} , less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II or ASTM D4869 Type III or Type IV shall be permitted to be installed as follows in 3.1–3.4:
 - 3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
 - 3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
 - 3.3. *Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
 - 3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $\frac{3}{4}$ inch (19 mm) into the roof sheathing.

**TABLE R905.1.1(1)
UNDERLAYMENT TYPES**

Portions of table not shown remain unchanged.

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, $V_{ult} < 140$ MPH	MAXIMUM ULTIMATE DESIGN WIND SPEED, $V_{ult} \geq 140$ MPH
Asphalt shingles	R905.2	ASTM D226 Type I <u>or Type II</u> ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM D6757

For SI: 1 mile per hour = 0.447 m/s.

Reason: The proposal makes two editorial changes. The alternate for ASTM D 1970 is redundant as that standard is listed in Section R905.1.1. Table R905.1.1 (1) includes ASTM D226 Type II for high wind areas; that material is also appropriate for lower wind zone areas.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is editorial.

RB274-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The committee approved this proposal based on the proponent's reason. The alternate for ASTM D1970 is redundant since it is listed in Section R905.1.1. Table R905.1.1(1) includes ASTM D226 Type II for high wind areas and is also appropriate for low wind zones. (Vote: 11-0)

Assembly Action:

None

RB274-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R905.1.1

Proponents:

T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen underlayment bearing a label indicating compliance to ASTM D1970, and installed in accordance with both the underlayment manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.

2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane bearing a label indicating compliance to ~~complying with~~ ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering for maximum ultimate design wind speeds, V_{uf} , less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips. Underlayment shall be applied in accordance with Table R905.1.1(2) using the application requirements for areas where wind design is not required in accordance with Figure R301.2(4)B. Underlayment shall be attached in accordance with Table R905.1.1(3).
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II or ASTM D4869 Type III or Type IV shall be permitted to be installed as follows in 3.1–3.4:
 - 3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
 - 3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
 - 3.3. *Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
 - 3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $\frac{3}{4}$ inch (19 mm) into the roof sheathing.

Commenter's Reason: This public comment corrects 2 errors. While underlayment complying with ASTM D1970 is mentioned in Section R905.1.1, it is not specifically mentioned in Tables R905.1.1(1), R905.1.1(2), or R905.1.1(3). The exception is needed to maintain some of the specific criteria for the use of this underlayment such as roof ventilation and climate exposure.

The second part corrects an error related to the use 4 inch wind strips complying with ASTM D1970 over the joints in the roof deck. In areas where wind design is required in accordance with Figure R301.2(5)B, the intent was for the underlayment to be ASTM D226 Type II or ASTM D4868 Types III or IV with the enhanced fastening. This public comment makes that correction and also adds an additional modification to correlate with RB275 which was Approved as Submitted by the IRC B Committee.

This public comment also clarifies labeling language for ASTM D1970 underlayment products that is consistent with other underlayment products referenced in this section.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The public comment will slightly increase the cost of construction. In areas where wind design is required, a heavier felt underlayment (30#) and enhanced fastening is required over the taped joints in the roof deck.

Public Comment# 1671

RB276-19

IRC®: TABLE R905.1.1(1), ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

2018 International Residential Code

Revise as follows:

**TABLE R905.1.1(1)
UNDERLAYMENT TYPES**

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, $V_{ult} < 140$ MPH	MAXIMUM ULTIMATE DESIGN WIND SPEED, $V_{ult} \geq 140$ MPH
Asphalt shingles	R905.2	ASTM D226 Type I ASTM D4869 Type I, II, III or IV ASTM D6757 <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM D6757 <u>ASTM WK51913</u>
Clay and concrete tile	R905.3	ASTM D226 Type II <u>ASTM WK51913</u> ASTM D2626 Type I ASTM D6380 Class M mineral- surfaced roll roofing	ASTM D226 Type II <u>ASTM WK51913</u> ASTM D2626 Type I ASTM D6380 Class M mineral- surfaced roll roofing
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type III or Type IV <u>ASTM WK51913</u>
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type III or Type IV <u>ASTM WK51913</u>
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type III or Type IV <u>ASTM WK51913</u>
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type III or Type IV <u>ASTM WK51913</u>
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM WK51913</u>	ASTM D226 Type II ASTM D4869 Type III or Type IV <u>ASTM WK51913</u>
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or Type IV <u>ASTM WK51913</u>
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757 <u>ASTM WK51913</u>	ASTM D4869 Type III or Type IV ASTM D6757 <u>ASTM WK51913</u>

For SI: 1 mile per hour = 0.447 m/s.

Add new text as follows:

ASTM WK51913 - ????: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This proposal references an ASTM Work Item for a new ASTM Standard that will apply exclusively to synthetic underlayments. The proposal simply stipulates new performance requirements for products that are already in widespread use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal references a proposed ASTM Standard that will, for the first time, apply specific performance requirements to synthetic underlayment products that are already in widespread use and will therefore not affect the cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913-???, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB276-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal was disapproved for consistency with the committee action on RB273. The referenced standard is not completed at this time. (Vote: 11-0)

Assembly Action:

None

RB276-19

Individual Consideration Agenda

Public Comment 1:

IRC@: ASTM Chapter 44 (New)

Proponents:

Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

ASTM WK51913 - ????-2019: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Commenter's Reason: The ASTM Work Item is still in process but there is a good chance that we will have a published standard prior to the FAH in October. This will establish a standard that relates directly to synthetic underlayments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal only adds a referenced standard that applies directly and specifically to synthetic underlayments. Thus, there is no cost impact.

Staff Analysis: In accordance with Section 3.6.3.1 of ICC Council Policy 28, the new referenced standard ASTM WK51913-2019, *Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing*, must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

RB277-19

IRC@: R905.3.1

Proposed Change as Submitted

Proponents: Shahen Akelyan, representing LAOBS and ICC IA Basin Chapter (shahen.akelyan@lacity.org)

2018 International Residential Code

Revise as follows:

R905.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid ~~sheathing or spaced~~ structural sheathing boards.

Reason: This section is amended to require concrete and clay tiles to be installed **only** over solid structural sheathing boards. The change is necessary because there were numerous observations of tile roofs pulling away from wood framed buildings following the 1994 Northridge Earthquake. The SEAOSC/LA City Post Northridge Earthquake committee findings indicated significant problems with tile roofs was due to inadequate design and/or construction. Therefore, the amendment is needed to minimize such occurrences in the event of future significant earthquakes. This amendment will reduce the failure of concrete and clay tile roofs during a significant earthquake and is in accordance with the scope and objectives of the International Building Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal limits the "spaces sheathing", therefore it does not increase any cost.

RB277-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It is not appropriate that these sheathing types should not be allowed anywhere but in high seismic zones. (Vote: 6-5)

Assembly Action:

None

RB277-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R905.3.1

Proponents:

Shahen Akelyan, representing ICC LA Basin Chapter (shahen.akelyan@lacity.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R905.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid ~~structural~~ sheathing boards.

Exception: Spaced lumber sheathing in accordance with Section R803.1 shall be permitted in Seismic Design Categories A, B and C.

Commenter's Reason: The proposed modification to the original proposal clarifies the structural board/sheathing and adds an exception to the projects in Seismic Design Categories A, B, and C. The intent of the proposal was to have a limitation in High Seismic Area. During the Committee Action Hearings in Albuquerque, New Mexico, we attempted to propose a floor modification that would have proposed the subject change and exception. Unfortunately, it was ruled out of order. However, with the original language, the proposal was disapproved with only 6-5 vote. The committee commented positively about the proposal and suggested to submit a public comment to bring in the floor modification.

The similar proposal and floor modification was submitted to the IBC under S25-19, and it was approved, as modified, by the committee. This proposal will be constant with the approved proposal in IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal limits the "spaced sheathing", therefore it does not increase any cost.

Public Comment# 1123

RB280-19

IRC@: R905.7.1

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Residential Code

Revise as follows:

R905.7.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other moisture impermeable material.

Reason: Moisture is driven into the shingles by the heating of the sun. When the back or interior side of the shingles are open to air the moisture and heat has two ways to escape the shingle, toward the inside and toward the outdoors. When foam insulation is added to the back side of the shingles, there is only one escape path. The foam also stops heat transfer and builds up the temperature of the shingle, resulting in more rapid deterioration from both moisture and heat.

Bibliography: Fiset, P. Housewraps, Felt Paper and Weather Penetration Barriers: Building Materials and Wood Technology, University of Massachusetts Amherst, 2001

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This change is primarily to stop a practice that often occurs as a retrofit. It is not a normal part of any construction process or system, but can sometimes be added to a building interior during modifications. No costs are involved when following standard construction practices.

RB280-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposed language is in the wrong section. This new text is too specific for spray foam and too broad for other materials. (Vote: 11-0)

Assembly Action:

None

RB280-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R905.7.1

Proponents:

David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R905.7.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. When wood shingles are installed over spaced sheathing the attic shall be ventilated in accordance with Section R806.1. The shingles ~~Spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other moisture~~

~~impermeable materials~~ material that prevents the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: In this case the spaced sheathing serves as the roof deck, so I believe this wording belongs in R905.7.1. The alternative placement of this requirement is Chapter 12, but as the issue is having the building interior surface of the shake open to air movement to remove moisture that permeates the wood, the installation and requirement is most likely understood by the roofer. Placing anything that traps moisture in the shake will shorten the shakes useful life. Although most drying of the shake is to the outside, there is some drying that must occur into the building. Any material that prevents the free movement of air on the interior side of the spaced sheathing prevents this drying, allowing moisture to accumulate in the bottom layer of shakes and accelerates wood deterioration. Direct backing of the shakes with insulating material of any type also raises the temperature of the shake, changes the differential between interior and exterior temperature and accelerates deterioration.

Bibliography: Jerrold E. Winand, H. Michael Barnes, Robert H. Falk; Summer temperatures of roof assemblies using western redcedar, wood-thermoplastic composite, or fiberglass shingles: FOREST PRODUCTS JOURNAL Vol. 54, No. 11

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This change is primarily to stop a practice that occurs in new construction and as a retrofit. Insulation and or other barrier products are sometimes added to a building attic interior directly to the interior side of wood shingles. The installation of any product on the interior side of spaced sheathing adds to the cost of construction. The cost of installation and future problems associated with deterioration of the wood will be eliminated if the material that prevents moisture movement is not installed and the system is free to breathe and dry. So in this case there is a savings in material and installation cost.

Public Comment# 1520

RB281-19

IRC@: R905.8.1

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Residential Code

Revise as follows:

R905.8.1 Deck requirements. Wood shakes shall be used only on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. Spaced sheathing shall not be backed with spray foam or other moisture impermeable material.

Reason: Moisture is driven into the shakes by the heating of the sun. When the back or interior side of the shakes are open to air the moisture has two ways to escape the shake, toward the inside and toward the outdoors. When foam insulation is added to the back side of the shakes there is only one escape path. The foam also stops heat transfer and builds up the temperature in the shake resulting in more rapid deterioration from both moisture and heat.

Bibliography: Fiset P.; Housewarps, Felt Paper and Weather Penetration Barriers: Building Materials and Wood Technology. University of Massachusetts, Amherst 2001

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This change is primarily to stop a practice that often occurs as a retrofit. It is not a normal part of any construction process or system, but can sometimes be added to a building interior during modifications. No costs are involved when following standard construction practices.

RB281-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved for consistency with the committee action on RB280. While the concept is okay, the proposed language is in the wrong location. (Vote: 11-0)

Assembly Action:

None

RB281-19

Individual Consideration Agenda

Public Comment 1:

IRC@: R905.8.1

Proponents:

David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R905.8.1 Deck requirements. Wood shakes shall be used only on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards

shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. Where wood shakes are installed over spaced sheathing the attic shall be ventilated in accordance with Section R806.1 The shakes. Spaced sheathing shall not be backed with spray foam or other moisture impermeable materials material that prevents the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: In this case the spaced sheathing serves as the roof deck, so I believe this wording belongs in Section R905.8.1. **The alternative placement of this requirement is Chapter 8, but as the issue is having the building interior surface of the shake open to air movement to remove moisture that permeates the wood, the installation and requirement is most likely understood by the roofer. Placing anything that traps moisture in the shake will shorten the shakes useful life.** Although most drying of the shake is to the outside, there is some drying that must occur into the building. Any material that prevents the free movement of air on the interior side of the spaced sheathing prevents this drying, allowing moisture to accumulate in the bottom layer of shakes and accelerates wood deterioration. Direct backing of the shakes with insulating material of any type also raises the temperature of the shake, changes the differential between interior and exterior temperature and accelerates deterioration.

Bibliography: Jerrold E. Winand, H. Michael Barnes, Robert H. Falk; Summer temperatures of roof assemblies using western redcedar, wood-thermoplastic composite, or fiberglass shingles: FOREST PRODUCTS JOURNAL Vol. 54, No. 11

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This change is primarily to stop a practice that occurs in new construction and as a retrofit. Insulation and or other barrier products are sometimes added to a building attic interior directly to the interior side of wood shakes. The cost of installation and future problems associated with deterioration of the wood will be eliminated if the material that prevents moisture movement is not installed and the system is free to breathe and dry. So in this case there is a savings in material and installation cost.

Public Comment# 1521

RB286-19

IRC@: AF103.7 (New), AF103.7.1 (New), AF103.7.2 (New), AF103.7.3 (New), AF103.7.4 (New)

Proposed Change as Submitted

Proponents: Dan Buuck, National Association of Home Builders, representing National Association of Home Builders (dbuuck@nahb.org)

2018 International Residential Code

Add new text as follows:

AF103.7 Sidewall Vent Termination. The vent pipe shall be permitted to be routed out the side of the building and terminated at the sidewall provided the requirements of this section are met.

AF103.7.1 Vent Location. The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

AF103.7.2 Vent Pipe. Vent pipe joints shall be solvent welded.

AF103.7.3 Fan. A radon fan shall be installed to activate the system and shall meet the following conditions:

1. The fan shall be a listed in-line fan designed for radon mitigation and be installed in accordance with NFPA 70 and the manufacturer's installation instructions.
2. The fan shall be airtight and installed within 4 feet (1219 mm) from the point the vent passes through the wall.
3. The fan shall have ready access for repair or replacement.
4. The fan shall be connected to a system failure alarm.

AF103.7.4 Testing. The radon system shall be tested as follows:

1. Testing shall be performed after the dwelling passes its air tightness test and after the radon control system and HVAC installations are complete.
2. The radon fan and HVAC system shall be operating during the test.
3. Testing shall be performed with the windows closed.
4. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit.
5. If the test result is 4 pCi/L or greater, then the system shall be modified and retested until the test result is less than 4 pCi/L.
6. The final test results shall be included with the construction documents.

Reason: The intent of this proposal is to allow sidewall venting of radon reduction systems without changing the other provisions of Appendix F. An active system is required if the sidewall venting option is chosen, but builders and owners still have the option of constructing a passive through-the-roof system. The sidewall termination option can provide advantages for those who have already decided to install a radon fan and want the benefits of simple vent routing or want to have better access to the fan for monitoring and maintenance. The side-vent option reduces ice formation on the roof vent. In cold climates ice forms on the roof vent as warm moist air meets cold outdoor air.

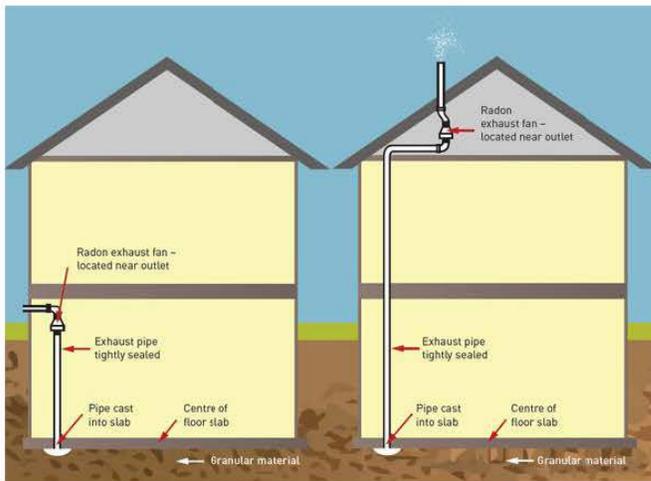


Research used to substantiate the U.S. requirement for roof venting (Henschel, 1995) showed a negligible re-entrainment level of 0.07 pCi/L when a concentration of 25 times the EPA action level was being exhausted at grade level. At the action level of 4 pCi/L the calculated re-entrainment level would be a negligible 0.003 pCi/L. This same research has been used as substantiation to allow sidewall radon vent termination in Canada (see Health Canada, *Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors*). Recent additional testing summarized below supports this view.

The following is from *Summary Report on Active Soil Depressurization (ASD) Field Study* (Health Canada, 2016), emphasis added. The 200 Bq/m³ in the quoted text below is the Canadian action level for radon.

"The second part of the study investigated how quickly radon levels dissipate with distance away from the side-wall discharge point. To do this, real-time radon dispersion measurements were conducted at 5 homes. At each home, arrays of approximately 10-15 continuous radon monitors were set up at fixed heights and distances away from where the exhaust is expelled, and measurements were conducted for a continuous period of roughly 6 hours. Generally speaking, radon levels fell from thousands of Bq/m³ to less than the 200 Bq/m³ guideline value within 1-2 metres, indicating a rapid decrease with distance.

"The long-term indoor post-mitigation results indicate that radon levels can be successfully lowered, and maintained, to levels well below the Canadian guideline value using an ASD mitigation system with an indoor mounted fan and side-wall discharge. This further implies that indoor leakage of radon from the system, and re-entry of radon into the home from the exhaust stream, were not issues of concern for the systems tested. As predicted, extreme cold climatic conditions did not cause freeze-up issues or impact the function of the ASD fan or system, as system components were not directly exposed to harsh conditions in the way they may be with the traditional geometry. The alternative, and conveniently less expensive, ASD geometry has been shown to be quite viable."





A sidewall termination can also be beneficial in cold climates where water vapor can freeze at the termination of tall, uninsulated systems, closing off the vent.

"Condensation problems can be reduced if the exhaust is discharged from a short pipe near ground level at right angles to the wall; similar to the exhausts from fan powered combustion appliances. ... A major advantage in cold weather areas is that the exposed discharge pipe is short and horizontal, reducing condensation and frost problems." (Health Canada, *Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors*).

When considering how big of an issue freezing can be, it's important to note that most of the Canadian population lives near the U.S. border in climate zone 6, which is the same climate zone that covers a significant portion of the northern U.S. This is demonstrated in the figure to the left which shows IECC climate zones extended into Canada. Coincidentally, the same region covers much of radon zone 1.

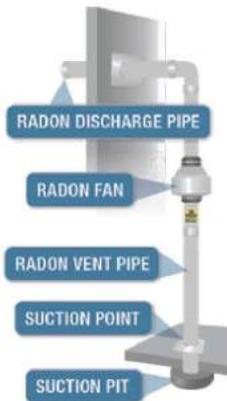


(Map credit: www.greenbuildingadvisor.com/article/climate-zone-map-including-canada)



The proposed language for the vent termination clearances was taken from IRC Section G2427.8 where it applies to a mechanical draft venting system. The power source for a future fan is adequately addressed in AF103.12.

The Canadian – National Radon Proficiency Program (C-NRPP) also recognizes sidewall terminations for radon reduction systems and shows the following image on its website (<https://c-nrpp.ca/radonreduction/>). The C-NRPP was established in 2014 as an agreement between the Canadian Association of Radon Scientists and Technologists and Health Canada.



Bibliography: Henschel, D. (1995). Re-Entrainment and Dispersion of Exhausts from Indoor Radon Reductions Systems: Analysis of Tracer Gas Data. *Indoor Air* 5(4):270-284. https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=128594.
 Health Canada. (2010). *Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors*. www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_contractors-entrepreneurs/index-eng.php.

Health Canada. (2014). *Radon Reduction Guide for Canadians*. www.canada.ca/en/healthcanada/services/environmental-workplace-health/reports-publications/radiation/radonreduction-guide-canadianshealth-canada-2013.html.

Health Canada. (2016). *Summary Report on Active Soil Depressurization (ASD) Field Study*. www.canada.ca/en/healthcanada/services/environmental-workplace-health/radiation/radon/summary-report-activesoil-depressurization-

fieldstudy.html.

"Understanding a Radon Mitigation System." Canadian – National Radon Proficiency Program, <https://cnrpp.ca/radonreduction/>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Installing an active radon system with a sidewall termination is an option, and the passive, through-the-roof option is still available.

RB286-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The proposal provides options and cost savings. The historical nature of the information from Canada cannot be denied. It is proven to work. The committee requested that the proponent clean up some of the language in the public comment period. (Vote: 7-4)

Assembly Action:

None

RB286-19

Individual Consideration Agenda

Public Comment 1:

IRC@: AF103.7.2 (New)

Proponents:

David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.2 Vent Pipe. Vent pipe joints shall be solvent welded. Above ground piping shall be supported by the structure of the building using hangers or strapping designed for piping support.

Commenter's Reason: Without structural support of the radon system piping the pipe could easily get dislodged and result in a catastrophic failure where radon gas is actively pumped into the structure.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Estimate an additional \$5 cost to secure the pipe.

Public Comment# 1797

Public Comment 2:

IRC@: AF103.7.4 (New)

Proponents:

David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.4 Testing. The radon system shall be tested as follows:

1. Testing shall be performed after the dwelling passes its air tightness test and after the radon control system and HVAC installations are complete.
2. The radon fan and HVAC system shall be operating during the test.
3. Testing shall be performed with the windows closed.
4. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit.
5. Testing shall be performed with a commercially available radon test kit; or testing shall be performed by an approved third party with a continuous radon monitor. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit manufacturer's instructions.
6. If the test result is 4 pCi/L or greater, then the system shall be modified and retested until the test result is less than 4 pCi/L.
7. The final written test results report with results less than 4 PCi/l shall be included with the construction documents, provided to the code official.

Commenter's Reason: Clarifies the testing procedure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Radon test kits are inexpensive, less than \$50 for the two test kits including laboratory determination of results. Tests by radon professionals will likely be more expensive.

Public Comment# 1798

Public Comment 3:

IRC@: AF103.7.3 (New)

Proponents:

David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.3 Fan. A radon fan shall be installed to activate the system and shall meet the following conditions:

1. The fan shall be a listed in-line fan designed for radon mitigation and be installed in accordance with NFPA 70 and the manufacturer's installation instructions.
2. The fan shall be airtight and installed within 4 feet (1219 mm) from the point the vent passes through the wall.
3. The fan shall have ready access for repair or replacement.
4. The fan shall be connected to a system failure alarm.
5. Piping joints and connections to fans and other components that are subject to fan- induced positive pressure shall be tested for leakage while the system is operating normally. Leak tests shall be conducted with a liquid bubble solution or an approved method.

System components found to be leaking shall be corrected in a manner recommended by the component manufacturer and the system shall be retested. Where system fans are tested with a liquid bubble solution, such fans shall be designed for outdoor installation.

After successful completion of the leak testing, a label shall be applied to the radon fan. The label shall read as follows:

"This system was tested for leaks during installation. Physical damage to or aging of the system could result in leakage that can increase indoor radon levels. It is advised that your radon system be routinely inspected and your radon levels be retested every 2 years or after structural changes to your home."

Commenter's Reason: This important leak test and labeling to provide notice to the occupants is a requirement in the Canadian Standard that RB286-19 was based upon. There is no justification for not requiring a leak test and warning to occupants for fans being mounted inside the thermal envelope. The section of the Canadian standard is reprinted here.

7.3.3 Conditions for mounting active soil depressurization fans indoors

7.3.3.1 Fan criteria

7.3.3.1.1 The radon fan used shall meet the product safety requirements in accordance with CAN/CSA-C22.2 No. 113 and the motor shall comply with the applicable requirements of CAN/CSA-C22.2 No.100 for motors having continuous duty.

7.3.3.1.2 The radon fan seams and enclosure openings other than the inlet and outlet ports, shall be sealed so that the combined area of all gaps or openings of the fan housing shall not exceed a total area of a single 3.17 mm (0.125in.) diameter hole which would result in a maximum 0.425 m³/h [0.25 cubic foot per minute (cfm)] leakage at 375 Pa (1.5in. WC pressure).

7.3.3.2 Leak test

7.3.3.2.1 The installer shall check each connection, fan joint and system component subject to fan- induced positive pressure while under normal operating pressure with either a liquid bubble solution or a leak-detection device to locate any source of a leak.

7.3.3.2.2 The installer shall seal any detected leak in a manner recommended by the component manufacturer and retest.

7.3.3.2.3 Fans requiring bubble leak testing or fans installed outdoors shall meet the requirements of CAN/CSA 22.2 No. 113 for outdoor use.

7.3.3.2.4 Leak test exception

Radon fans mounted outdoors, in attics or attached garages, or radon fans with all critical seams under

CAN/CGSB-149.11-20XX

negative pressure or housed in a negative pressure enclosure shall not require a leak test.

7.3.3.3 Labelling

After completion of the leak test, a label shall be applied to the radon fan by the installer. The label shall contain the following information:

“The Installer has tested this system for leaks during installation. Please note that physical damage or aging may result in leakage which can increase indoor radon levels. You are advised that your system should be routinely inspected and your radon levels retested every 5 years or after major structural, or ventilation/air circulation equipment changes to your home.”

« L'installateur a soumis ce système à un essai d'étanchéité durant son installation. Veuillez noter que tout dommage matériel ou vieillissement pourrait provoquer une fuite qui, à son tour, pourrait faire augmenter la concentration de radon dans l'air intérieur. Il vous est conseillé d'inspecter régulièrement votre système et de mesurer la concentration de radon tous les cinq ans ou après des modifications importantes apportées à la structure, à l'équipement de ventilation ou au système de circulation d'air de votre habitation. »

Bibliography: Canadian General Standards Board (CGSB) CAN/CGSB-149.11-20xx "Radon control options for new construction in low-rise residential buildings"
<https://www.carst.ca/resources/Documents/CGSB-149.11-2015CD-01.pdf>

Health Canada. (2010). Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors. www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_contractors-entrepreneurs/index-eng.php.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Estimated cost increase is \$5 to perform this simple test and apply label.

Public Comment# 1802

Public Comment 4:

IRC@: AF103.7.1 (New)

Proponents:

Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.1 Vent Location. The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than ~~4 6~~ feet (~~+219~~ 1829 mm) below, ~~4 6~~ feet (~~+219~~ 1829 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

Commenter's Reason: The single purpose of a radon system is to prevent occupant exposure to radon by sucking the radon from under the ground into an airtight pipe assembly and exhausting it outside the building. The only proven method is to exhaust the radon above the roof, which is far from occupants.

The proposed clearances for sidewall venting between the radon system vent termination and windows, doors, and gravity air intake openings into the building are not protective. The mechanical draft venting provision for fuel gas appliances contained in IRC Section G4247.8 to an exhaust pipe was not designed for preventing exposure to radioactive cancer-causing radon gas.

The Canadian standard - CGSB 149.11 - on which this sidewall venting code change proposal was based - requires two meters (6.5 feet) clearance from windows and gravity air inlets and recommends same for doors. We propose that the clearance be 6 feet. We would note that the ANSI-AARST CCAH standard requires 10 feet.

The following table displays clearances for doors, windows, and gravity air inlets from the Canadian and American National consensus standards, those contained in the code change proposal and ones contained in this comment.

Required Clearances for Radon Gas Exhaust				
Location	CGSB 149.11 <u>in meters (ft)</u>	ANSI-AARST CCA	NAHB Proposed AF103.7.1	<u>This Modification</u>

Clearance to air supply inlet	2 (6.5 ft)	10 ft from, 2 ft above	4 ft below, 4 ft from, 1 ft above	6 ft from
Clearance from a window	2 (6.5 ft)	10 ft from, 2 ft above	4 ft below, 4 ft from, 1 ft above	6 ft from
Clearance from a door	1 (3.25 ft) required; 2 (6.5 ft) recommended;	10 ft from, 2 ft above	4 ft below, 4 ft from, 1 ft above	6 ft from

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The incremental cost of the code change is \$2 for 2' of extra pipe material.

Public Comment# 1924

Public Comment 5:

IRC@: AF103.7.1 (New)

Proponents:

Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc. (dave@spruce.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.1 Vent Location. The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

Commenter's Reason: The single purpose of any radon system is to prevent occupant exposure to radon by sucking the poison from under the ground into an airtight pipe assembly and exhausting it outside the building. The only proven method is to exhaust the radon above the roof, which is far from occupants.

The prohibition of installation over public walkways is an important protection. The same attention should be extended to all walkways: the owner/occupants of the property deserve the same protection as neighbors/passersby.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The modification does not change the materials and labor cost of the radon system.

Public Comment# 1923

Public Comment 6:

Proponents:

Bill Angell, University of Minnesota, representing North Star AARST (wangell@umn.edu)

requests Disapprove

Commenter's Reason: 1. Radon is radioactive and is the most severe environmental health risk in the home. As such, it is appropriate for public health policy to set risk level at low as reasonably achievable (ALARA). Research clearly indicates indoor fans and sidewall fan discharges violate ALARA and thus, should not be allowed.

1.1. The greatest house infiltration occurs at or near the rim joist - - - sidewall discharges are at this vulnerable point. Available research indicates re-

routing ASD exhaust above the highest roof level reduces indoor radon concentrations.

- 1.2. Indoor radon fans pose a serious health risk due to radon leaks as an increasing number of exhaust pipe and fan connectors disconnect with age.
- 1.3. Compared to combustion appliance exhaust, soil gas exhaust is cooler and thus, has a greater tendency to pool near the discharge and re-entrain into the building as well as increase potential outdoor exposure.
- 1.4. The World Health Organization reviewed radon ASD fan and discharge locations made a consensus recommendation consistent with U.S. ANSI/AARST mitigation standards.
2. NAHB claims sidewall discharges have a benefit of remaining ice-free yet there is no available research that supports the NAHB claim. Furthermore, decades of interior routed, above roof ASD discharges in the northern U.S. have not produced significant freeze-up issues.
3. The stated rationale of the NAHB proposed IRC Appendix F change assumes a relatively low level of radon concentration (100 pCi/L) while the discharge concentration can be significantly greater (10 to 50 times greater).
4. Research cited by NAHB to support its indoor fan and sidewall discharge proposal has serious limitations NAHB fails to cite.
 - 4.1. Several research papers recommend assessments during warm seasons (when the pooling of cool soil gas on the ground surface and re-entrainment are most likely) yet, that research is not available.
 - 4.2. No research addresses the risks of outdoor exposures of children playing in high soil gas concentrations nor adults occupying areas near sidewall discharges. Radon concentrations within 6 feet of sidewall discharge average 15 times background
5. The radon testing component of the NAHB radon sidewall discharge proposal fails to follow ANSI/AARST mitigation standards and thus, may result in elevated indoor radon exposure.

Bibliography:

- Brossard, M., Ottawa, C., Falcomer R., Whyte, J., 2014 Radon mitigation in cold climates at Kitigan Zibi Anishinibeg, *Health Physics*, 108(1S), S13-S18
- Health Canada 2016 *Summary Report on Active Soil Depressurization (ASD) Field Study* Ottawa, ON: Health Canada.
- Henschel, DB 1995 Re-entrainment and dispersion of exhausts from indoor radon reduction systems: Analysis of tracer gas data, *Indoor Air*, 5: 270-284.
- Henschel, DB 2004 Cost analysis of soil depressurization techniques for indoor radon reduction, *Indoor Air*, (April).
- Hunter, AR 1995 Spatial and temporal variations of soil gas ²²⁰Rn and ²²²Rn at two sites in New Jersey *Proceedings of the 1996 International Radon Symposium*, Fletcher, NC: AARST.
- Maeda, L and Hobbs, W 1996 Outdoor radon concentrations in the vicinity of an active home radon mitigation system, *Proceedings of the 1996 International Radon Symposium* (I1 -4.7), Fletcher, NC: AARST.
- Mooman, L 2016 Radon discharge locations that are shown to affect interior radon concentrations negatively, *Proceedings of the 2016 International Radon Symposium*, Fletcher, NC: AARST.
- Neff, D, Meroney, R and El-Badry, H 1994a *Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses* (Final Report). Fort Collins: Fluid Mechanics and Wind Engineering Program, Colorado State University.
- Neff, D, Meroney, R and El-Badry, H 1994b *Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses* (Project Summary); EPA/600/SR-94/115). Research Triangle Park, NC: Air and Energy Engineering Research Laboratory.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2017

Public Comment 7:

Proponents:

Thomas Bowles, United States Environmental Protection Agency, representing United States Environmental Protection Agency (bowles.thomas@epa.gov)

requests Disapprove

Commenter's Reason: From a public health standpoint, sidewall venting in radon mitigation systems is not considered a best practice. EPA does not support sidewall venting as described in the proposal; the construction methodology lacks adequate safeguards to protect against concentrated radon blowing directly into an enclosed space, in the event a pipe breaks or is damaged. As written, the proposal suggests the vent should pass through the wall of a home. When the pressurized side of the system is inside the home, breakages and penetrations in the fan housing or pipe will leak directly into the home and could present a very high-risk exposure scenario.

The potential for damage and component failure exists in any radon mitigation system. This proposal does not require adequate safeguards.

Occupants will not receive a warning in the event a pipe is damaged or leaking. This means an occupant would be unaware if highly concentrated radon was leaking into a conditioned space. The proposal references Canadian guidance (Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors) to support the position of sidewall venting; however, it lacks a critical safeguard the Canadian guidance requires which is the installation of a continuous radon radiation monitor (CRM). The addition of a CRM could alert occupants to flaws in the system and prevent exposures that can cause lung cancer. Some stakeholders have argued in support of the proposal, by referencing codes that allow other dangerous gasses, such as carbon monoxide (CO), to be generated inside the conditioned space and exhausted outdoors through pressurized pipes located within the building envelope. However, in every case where this is true, the code requires the use of a CO monitor. (2015 IBC Section 915) As written, this proposal does not require a CRM, which is inconsistent with other codes addressing dangerous gasses and lacks necessary public health protections. (National Standard of Canada 5.1.7)

The proposal does not do enough to address re-entrainment of radon gas re-entering the home through windows, vents, or other pathways after it is exhausted outside. There is not enough evidence to show a vent termination located 4' below an open window (RB286-19, AF103.7 Vent Location 2.) does not pose a potential health risk through re-entrainment.

Finally, the proposal seeks to support sidewall venting by stating that it can be beneficial in cold weather climates due to condensation and freezing concerns. In a comparative study on different options for fans and exhausts positioning, "Icing occurrences were found in similar numbers in January 2011 for both exhaust scenarios." While active soil depressurization systems that exhaust above the roof line proved to be 3.5 times more susceptible to obstructive icing, in the study, the side-venting is not immune. During the study when temperatures reached below -20 degrees C° "only one case of severe obstruction (more than 50% of pipe area) was reported" for the above the roof line discharges in the study and, "neither radon reduction nor suction pressures were im-paired in this worst case." (**Anishinabeg et al, 2012**)

Sources Utilized

2015 IBC Section 915 <https://codes.iccsafe.org/content/IBC2015/chapter-9-fire-protection-systems>

National Standard of Canada http://publications.gc.ca/collections/collection_2017/ongc-cgsb/P29-149-012-2017-eng.pdf

Residential Radon Mitigations at Kitigan Zibi Anishinabeg: Comparison of Above Ground Level (Rim Joist) and Above Roof Line Discharge of Radon Mitigation Sub-Slab Depressurization Systems, M. Brossard, M. Brascoupé, C. Brazeau-Ottawa, R. Falcomer, W. Ottawa, and J. Whyte, Health Physics, V 102, pp S43-S47, May 2012.

RB286-19 AF103.7.1 Vent Location.

The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.

4. Not less than 12 inches (305 mm) above finished ground level.

Bibliography: 2015 IBC Section 915 <https://codes.iccsafe.org/content/IBC2015/chapter-9-fire-protection-systems>

National Standard of Canada http://publications.gc.ca/collections/collection_2017/ongc-cgsb/P29-149-012-2017-eng.pdf

Residential Radon Mitigations at Kitigan Zibi Anishinabeg: Comparison of Above Ground Level (Rim Joist) and Above Roof Line Discharge of Radon Mitigation Sub-Slab Depressurization Systems, M. Brossard, M. Brascoupé, C. Brazeau-Ottawa, R. Falcomer, W. Ottawa, and J. Whyte, Health Physics, V 102, pp S43-S47, May 2012.

RB286-19 AF103.7.1 Vent Location.

The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
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3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1991

Public Comment 8:

Proponents:

Gary Hodgden, AQP Inc, representing Self (gary@aair.com)

requests Disapprove

Commenter's Reason: Attached are more details.

My objection speaks to words in the ICC code of ethics as phrased many ways in a dozen publications:

"The protection of the health, safety and welfare of the public by creating safe buildings and communities is the solemn responsibility of the International Code Council ("ICC") and all who participate in ICC activities."

The overwhelming health hazard:

The proposal assumes no responsibility for an inevitable number of incidental damage events that will occur to fan/pipe connections to result in blowing extremely hazardous exhaust directly into conditioned space. This can occur simply when moving furniture or with teenagers wrestling in a basement.

As such, these designs are effectively illegal in almost a dozen states.

For this safety concern, the proposal does NOT include any of the following:

- Requirements for strapping and supports that would prevent any movement to piping or fans so that the likelihood of pipes falling loose would be less;
- Labeling to warn occupants of the hazard if pipes fall loose;
- Labeling for what system is or for system failure alarms; or
- A radiation monitor that would alert occupants if the pipe falls loose.

The proposal also does NOT account for:

- A requirement, “the discharge shall be directed away from the building” that is an integral part of in similar code text for mechanical draft vents M1804.2.6. Without this requirement, all safety distances cited from openings are inadequate.
- A requirement, “shall not blow exhaust air that can contain chemical vapors at people”
- Fan driven exhaust air that encounters irregularities in construction, such as a ½ inch gap where the roof eave meets the siding
- Safe distances from other buildings (e.g., 20 ft)

Studies cited on exhaust air entering the building

The proposal casually dismisses conclusions of building and radiation scientists who spent years studying the issue for EPA. Instead, this proposal favors a publication written by a manufacturer of a side-vent fans who selectively omitted or did not understand portions of one very limited and truncated EPA publication.

Misconstrued premise: Ice

A justification for the proposal erroneously includes concerns of ice formation at roof-vents, as experienced in Canada for exterior exhaust piping. But Canada requires interior piping for new construction.

It is a simple fact that “warm moist air” exhausted into “freezing air” can form ice at any location.

Reference titles and links:

Full Comment NAHB RB286-19 Proposal-GaryHodgden

<https://drive.google.com/file/d/1viPVFrzLC3a5bVT0VyUI5cxi1EkEGjZ/view?usp=sharing>

Moorman in 2016 (*Radon Discharge Locations That Are Shown To Affect Interior Radon Concentrations*)

<https://drive.google.com/file/d/1kBhKdgTbowcnmOpfkr6cXwzc2ED0x5Pi/view?usp=sharing>

ASHRAE research project 1635-TRP that reveals the problems (*“Simplified Procedure for Calculating Exhaust/Intake Distances”*)

<https://drive.google.com/file/d/1rzYmNnYp1bmkq0g46cGi8mTB3P2pdzS/view?usp=sharing>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1484

Public Comment 9:

Proponents:

Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc. (dave@spruce.com)

requests Disapprove

Commenter's Reason: Sidewall radon venting is not a proven method of excluding radon from the home environment. The cancer risks to occupants indoors from re-entrainment of radon into the building, and to occupants or anyone else who spends more than ten minutes outdoors near the point of exhaust from the radon system far outweigh the benefits claimed by the advocates for this proposal. Further, the unrealistic value of 100 pCi/L the proponents cite in their re-entrainment calculations does not address homes with radon potentials as high as 6,176 pCi/L found in Pennsylvania.

This proposal is not code-ready: research is needed to clarify that such system will not cause new exposure risk for occupants, children playing outside and passersby. Specifically, we know of no definitive peer-reviewed research that indicates that sidewall venting is as effective year-round, or in all climates and building types, compared to roof-top discharge. *To the contrary, anecdotal evidence from US radon system professionals, as well as a study of 97 homes in New Jersey, have demonstrated the potential for increasing human exposure to radon from sidewall venting.*

We simply don't know whether it never or always results in indoor radon levels higher than roof top exhaust, or that ground-level exhaust always or never exposes persons spending time near that ground-level exhaust. We do know that roof-top exhaust in a properly installed system will reduce indoor radon levels and will not expose persons (unless they choose to spend leisure time on the roof not designed for human occupancy). *Why allow into Appendix F a risky business proposition that will haunt code officials who sign off on it and builders who implement it and design professionals who prescribe it?*

When radon gas is discharged via a radon mitigation system above the roof, the radon concentration falls off dramatically from the point of discharge, to as low as background levels below the discharge point. Ground level discharge of radon has been disallowed in the US since the early 1990s, primarily because of the potential for re-entrainment of the gas into the house and the potential leakage from the fan and piping inside the building envelope.

The proponent rationale for sidewall venting in cold climates is unproven: *obstructive icing of a radon pipe is not a common problem in the experience of radon professionals in the US, and the one Canadian study that documented it found only 50% ice blockage - on one of 63 homes -*

and there was no reduction in mitigation performance.

It must be noted that the only current US consensus standard for radon control in the new construction of one and two family homes, ANSI-AARST CCAH, requires that radon systems exhaust at least 10 feet from ground level. Why? The evidence (presented in the bibliography and by others) is clear: *soil gas exhaust at ground level has significantly higher levels of radon than rooftop soil gas exhaust.*

Bibliography: 1. Studies relevant to this subject

Bernier, J and Brossard, M 2013 *Outdoor Radon Dispersion: Comparison of Lateral vs. Vertical Exhaust of Radon Sub Slab Depressurization Systems*, Maniwaki, QB: Kitigan Zibi Anishinabeg and Montreal, QB: Health Canada Quebec Regional Office (June 20 Teleconference)

This paper reviewed above ground level (lateral) (AGL) and above roof level (ARL) discharges, using six-minute grab samples and 45 day detectors in October and November 2012. The authors note that *most of lateral AGL dispersion of elevated radon occurs within the first 2 meters (6.5 feet) of exhaust* and recommend clearance for outdoor occupancy areas (e.g., balcony, terrace) as well as study of indoors and during warm weather.

Brodhead, B Clarkin, M and Brennan, T 1993 *Initial results from follow-up of New Jersey homes mitigated for radon, Proceedings of the 1993 International Radon Symposium*, Fletcher, NC: AARST

This project involved house diagnostics and four quarterly E-PERM measurements taken in three locations at 97 single-family homes in New Jersey. Houses with elevated post mitigation results were included in the selection so that mitigation failures could be located and evaluated. Measurements were made of the radon system exhaust and revealed radon concentrations as high as 485 pCi/L and thoron levels as high as 10,000 pCi/L. A second phase of the study included follow-up work at fifteen of the original houses that had at least one quarterly measurement elevated. Additional diagnostics and system alterations were done on these houses to improve the performance of (he initial mitigation. **Two homes with sidewall venting were shown to have re-entrainment which caused elevated indoor radon levels.**

Brossard, M., Ottawa, C., Falcomer R., Whyte, J., 2014 Radon Mitigation in Cold Climates at Kitigan Zibi Anishinibeg, *Health Physics*, 108(1S), S13-S18

While this study indicates that a sealed radon fan having proper fittings and sealed piping in one-story homes was able to reduce the radon to acceptable levels with above ground discharge, and that these installations were less subject to obstructive icing of the exhaust in cold climates, it also showed that there was only a single instance of obstructive icing among homes with roof top discharge and the icing did not interfere with radon reduction. The authors noted the need to repeat the study in homes with more than one story, during the warm weather, and in urban and suburban homes.

Moorman, L 2016 Radon Discharge Locations that are Shown to Affect Interior Radon Concentrations Negatively, *Proceedings of the 2016 International Radon Symposium*, Fletcher, NC: AARST

This study reviewed two passive radon mitigation systems installed as RRNC during new home construction with high radon concentrations larger than the EPA action level. By process of elimination, the discharge locations were the last potential cause. Rerouting the vent pipes to bring the discharge location in compliance with current standards lowered the radon levels in these re-entrainment cases. The author presented a comparison of radon discharge and flue gases, noting "one can state that flue gas is very noticeable and an immediate deterrent when the public is around it, whereas radon discharge gas is not noticeable and thus not a deterrent for the unsuspected public."

	Flue Gases	Radon
Timing	Intermittently operating	Constant operation
Smell	Detectable odor when on	Odorless
Sound	Considerable sound when on	Generally, background sound
Visual	Smoke cloud when on	Transparent
Temperature	Warm or hot when on	Cool
Health Concern	CO at start, then CO ₂ when on	Radioactivity

Neff, D, Meroney, R and El-Badry, H 1994a *Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses (Final Report)*, Fort Collins: Fluid Mechanics and Wind Engineering Program, Colorado State University

The objective of this study was to identify whether there are conditions under which the mitigation radon exhaust for typical homes can safely be released at grade level. The results from these tests determined that:1) Exhaust gases will recirculate heavily into the house wake for all three effluent sources tested whenever the stacks are located downwind of home's roof crest; 2) *The at-grade wall release location usually leads to the highest building surface concentration values.* The eave release location leads to somewhat higher concentrations than the roof release location; 3) Source strengths of 100 pCi/L produced concentrations greater than the design value of 1 pCi/L only for wall releases, and the maximum of these was only 1.4 pCi/L. Source strengths of 1000 pCi/L produced concentrations greater than design value of 1 pCi/L at sampling locations for all three effluent release locations.

A related paper (Neff, D, Meroney, R and El-Badry, H 1994b *Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses (Project Summary; EPA/600/SR-94/115)*, Research Triangle Park, NC: Air and Energy Engineering Research Laboratory) noted: The tracer gas results show that grade-level exhausts consistently result in the highest tracer concentrations against the face of the house, although these concentrations may not be serious if exhaust concentrations are low. The highest concentration measured at one point against the side of the house over all runs with grade-level exhaust would correspond to 30 Bq/m3 (0.8 pCi/L) if the exhaust contained 3,700 Bq/m3 (100 pCi/L), and 300 Bq/m3 (8.1 pCi/L) if the exhaust contained 37,000 Bq/m3 (1,000 pCi/L).

2. Additional Lessons from Studies Cited by The Proponent

Health Canada 2016 *Summary Report on Active Soil Depressurization (ASD) Field Study Ottawa, ON: Health Canada*
www.canada.ca/en/healthcanada/services/environmental-workplace-health/radiation/radon/summary-report-activesoil-depressurization-fieldstudy.html

- 1) There is no evidence supporting the claim that a vertical roof-top ASD discharge is "highly susceptible to ice or snow blockage."
- 2) Authors recommend follow-up study of long-term performance.

5: 270-284

- 1) Tests in the field suggest that active soil depressurization systems exhausting at grade level can contribute indoor radon concentrations 3 to 9 times greater than systems exhausting at the eave;
- 2) Grade-level exhaust can contribute mean concentrations beside houses averaging 7 times greater than exhaust at the eave, and 25 to 50 times greater than exhaust midway up the roof slope; and
- 3) Exhaust location was found to have a statistically significant ($p < 0.0001$) effect on re-entrainment with grade-level exhaust having greater impact on indoor radon concentrations in a home where the concentrations were relatively low.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1900

Public Comment 10:

Proponents:

Ruth Mcburney, Conference of Radiation Control Program Directors, representing Conference of Radiation Control Program Directors (rmcburney@crcpd.org)

requests Disapprove

Commenter's Reason: The Conference of Radiation Control Program Directors (CRCPD) is a nonprofit non-governmental professional organization dedicated to radiation protection. With these comments, the CRCPD is representing the state radon programs in the United States.

Much like how the ICC is focused on protection of the health, safety, and welfare of the public, the CRCPD's primary goal also focuses on public health through working to assure that radiation exposure is kept to the lowest practical level.

Radon is a cancer causing radioactive gas found in the soil that enters buildings throughout the United States. Part of CRCPD's mission is to work with states and tribes to reduce the lung cancer burden by lowering radon in buildings. The goal of radon reduction is to get it as low as reasonably achievable (ALARA). The NAHB sidewall discharge proposal RB286-19 violates the protocols and standards approved in the United States for radon mitigation and increases the health risk to our citizens through an increased risk of elevated radon exposure.

There are numerous reasons why this proposal will put the health, safety and welfare of the public at increased risk. The amount of radon in the soil is 100s or 1,000s times greater than what enters a typical structure and many times greater than the cited values from the Canadian research referenced by the proposal's author. Radon should be kept out of and as far away from the structure as possible.

1. Extensive field experience and scientific research in the United States has shown improperly vented radon system exhaust points such as included in the RB286-19 proposal can lead to radon re-entering the structure. The research provided in support of the RB286-19 proposal lacks statistical credibility. We have a strong and documented history of radon mitigation systems successfully lowering radon exposures. There are more than one million radon mitigation systems installed in the US which are properly vented and do not pose a threat to the health and safety of unsuspecting occupants.
2. Radon fans located in the conditioned space of the building can leak and thereby increase the amount of radon in the building without anybody knowing. A system with the radon fan located inside the home puts the family at greater risk.
3. Positively pressurized radon system piping located indoors can leak and allow highly concentrated levels of radon and other soil gasses into the structure increasing exposure to radon and other unknown soil gas contaminants to the public. Many of these contaminants can be very toxic.
4. Venting radon systems as proposed will violate **multiple** state regulations currently in place throughout the country. The methods proposed in RB286-19 are illegal in every state which has a regulatory program for radon mitigation and violate established standards and protocols in the United States
5. Justification for this proposal incorrectly uses existing exterior radon system freeze-ups as a reason to limit the amount of pipe exposed outdoors. In new construction, systems are routed through the interior of the house through the roof thereby limiting the amount of uninsulated pipe exposed to the elements. Field experience from Minnesota, where a variation of Appendix F has been in energy or building code for ten years, shows interior pipe routes do not freeze up in the winter. The issues presented by the author mix up the Canadian examples of exterior radon mitigation systems installed **after** construction with systems installed preconstruction (routed interior through the roof that do not freeze in a cold climates).
6. If a radon system as prescribed in this proposal was to fail, it would put the inhabitants at a 100-1000x greater exposure to radon and any other soil gas or vapors that may be under the building. This includes Volatile Organic Compounds (VOCs) including methane, TCE and other VOCs and carcinogens. Because we are not able to continually monitor radon or other soil gas contaminant levels in homes with a practical and low-cost method, there is no means for the occupants to know if they are being exposed to these dangerous chemicals and carcinogens.

7. Venting radon systems like flue gases from modern power vented appliances is not a safe practice. The radon concentrations leaving the exhaust point can be extremely high and have a virtually unlimited supply. Unlike flue gases which are not continuously vented and are easily recognized, radon exhaust is continuous and is an invisible, odorless, colorless radioactive gas.
8. Installation of active radon systems as proposed will burden the builder with increased installation costs and increased liability. The liability of the home builder for lung cancer cases in people is much higher when they install these systems knowing that the system potentially causes greater radon exposure to the residents both from venting a known carcinogen into breathing space outdoors, and from the indoor risks of fan and/or pipe exhausting dangerous chemicals and carcinogens into the home.
9. The World Health Organization reviewed radon fan discharge locations and made a recommendation consistent with U.S. ANSI/AARST mitigation standards – do not vent the radon system through the side-wall of the building. Instead exhaust the radon up and away from the structure.

Radon is the largest contributor of radiation exposure for the general public and most of the exposure occurs in the home. It is the deadliest environmental concern in homes today and is responsible for more deaths than drunk driving, fires, and falls combined. Radon exposure should be treated as a severe public health risk and we need to better protect the American public. This proposal does not protect the public. CRCPD and the state and tribal radon programs we represent are strongly against this proposal and believe it should be deleted from the ICC Code in its entirety.

References

Brodhead, B Clarkin, M and Brennan, T 1993 Initial results from follow-up of New Jersey homes mitigated for radon, Proceedings of the 1993 International Radon Symposium), Fletcher, NC: AARST

Radon and Thoron were measured in system exhausts. Levels were found to be very high and may pose a threat to health and safety if not properly vented. Gamma radiation measurements were made on site to compare to average state gamma readings. The post-mitigation gamma radiation was 20% higher than the state gamma average.

Henschel, DB 1995 Re-entrainment and dispersion of exhausts from indoor radon reduction systems: Analysis of tracer gas data, Indoor Air, 5: 270-284

Re-entrainment tests in the field suggest that active soil depressurization systems exhausting at grade level can contribute indoor radon concentrations 3 to 9 times greater than systems exhausting at the eave. With 37,000 Bq/m³ (1,000 pCi/L) in the exhaust, the highest mean concentrations beside the house could be less than or equal to the ambient background level with eave and mid-roof exhausts, and 2 to 7 times greater than ambient with grade exhausts.

Neff, D, Meroney, R and El-Badry, H 1994a Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses (Final Report). Fort Collins: Fluid Mechanics and Wind Engineering Program, Colorado State University

The objective of this study was to identify whether there are conditions under which the mitigation radon exhaust for typical homes can safely be released at grade level. Results showed the safest exhaust location was above the eave and the at-grade wall release location lead to the highest building surface concentrations.

Neff, D, Meroney, R and El-Badry, H 1994b Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses (Project Summary; EPA/600/SR-94/115). Research Triangle Park, NC: Air and Energy Engineering Research Laboratory

The tracer gas results show that grade-level exhausts consistently result in the highest tracer concentrations against the face of the house. The highest concentration measured at one point against the side of the house over all runs with grade-level exhaust would correspond to 30 Bq/m³ (0.8 pCi/L) if the exhaust contained 3,700 Bq/m³ (100 pCi/L), and 300 Bq/m³ (8.1 pCi/L) if the exhaust contained 37,000 Bq/m³ (1,000 pCi/L).

Moorman, L 2016 Radon discharge locations that are shown to affect interior radon concentrations negatively, Proceedings of the 2016 International Radon Symposium, Fletcher, NC: AARST

Passive radon mitigation systems installed as RRNC during new home construction were found to have discharge locations close to walls extending vertically above them. Rerouting the vent pipes to bring the discharge location in compliance with current standards lowered the radon levels on multiple floor levels. Paper concludes: "Extra due diligence is required from standard writing in the radon community compared to standard writing for flue gas discharge location. The reason can be summarized by stating that flue exhaust gas is very noticeable and annoying, thus acts as a natural deterrent for the public but radon discharge gas is barely noticeable and thus does not have this deterring effect on the public when present."

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This proposal requires a radon fan which makes it more expensive.

RB288-19

IRC@: SECTION AF101, AF101.1, SECTION AF102, AF102.1, , (New), SECTION AF103, AF103.1, AF103.2, FIGURE AF103.2, AF103.3, AF103.3.1 (New), AF103.3.2 (New), AF103.3.3, AF103.4, AF103.4.1, AF103.4.2, AF103.5, AF103.5.1, AF103.5.2, AF103.5.3, AF103.5.4, AF103.5.5, AF103.5.6 (New), AF103.5.6.1, AF103.5.6.2 (New), AF103.5.6.3, AF103.6, AF103.6.1, AF103.6.2, AF103.6.3, AF103.6.4, AF103.6.5, AF103.4.3, AF103.4.6, AF103.4.7, AF103.4.8, AF103.4.9, AF103.11, FIGURE AF101, TABLE AF101(1), ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc. (dave@spruce.com)

2018 International Residential Code

SECTION AF101 SCOPE

Revise as follows:

AF101.1 General. This appendix contains requirements for radon control methods in new construction. ~~new construction in jurisdictions where radon-resistant construction is required.~~

~~Inclusion of this appendix by jurisdictions shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101 and Table AF101(1)~~

Add new definition as follows:

SECTION AF102 DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

Delete without substitution:

~~**DRAIN TILE LOOP.** A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or crawl space footing.~~

Revise as follows:

~~**RADON GAS.** A naturally occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings. The element Rn, which is a radioactive colorless, odorless, tasteless, cancer-causing gas that occurs naturally as a decay product of radium.~~

Add new definition as follows:

~~**RADON ROUGH-IN.** The installation of all parts and materials of sub-membrane or sub-slab depressurization system including gas permeable layers, soil gas retarders, membranes, piping, connectors, terminations, and power sources.~~

~~**SOIL-GAS-RETARDER.** A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.~~

Revise as follows:

~~**SUBMEMBRANE DEPRESSURIZATION SYSTEM.** A system designed to achieve lower submembrane air pressure relative to crawl space air pressure by use of a fan-powered vent drawing air from beneath the soil-gas-retarder membrane.~~

~~**SUBSLAB DEPRESSURIZATION SYSTEM (Active).** A system designed to achieve lower subslab sub-slab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.~~

Delete without substitution:

~~**SUBSLAB DEPRESSURIZATION SYSTEM (Passive).** A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe routed through the conditioned space of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.~~

SECTION AF103 REQUIREMENTS

Revise as follows:

AF103.1 General. The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary (~~see Figure AF103~~). ~~These techniques are required in areas where designated by the jurisdiction.~~

AF103.2 Subfloor preparation. Radon Rough-In ~~A radon rough-in is required for all foundation types, including crawlspace, basement, slab on grade, and slab on grade garage located below a living area as shown in Figure AF103.2. The rough-in shall be installed prior to pouring of concrete slabs, closure of building cavities, and installation of finish materials. layer of gas permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a subslab depressurization system, if needed. The gas permeable layer shall consist of one of the following:~~

- ~~1. A uniform layer of clean aggregate, not less than 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a $\frac{3}{4}$ -inch (6.4 mm) sieve.~~
- ~~2. A uniform layer of sand (native or fill), not less than 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.~~
- ~~3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.~~

Delete and substitute as follows:

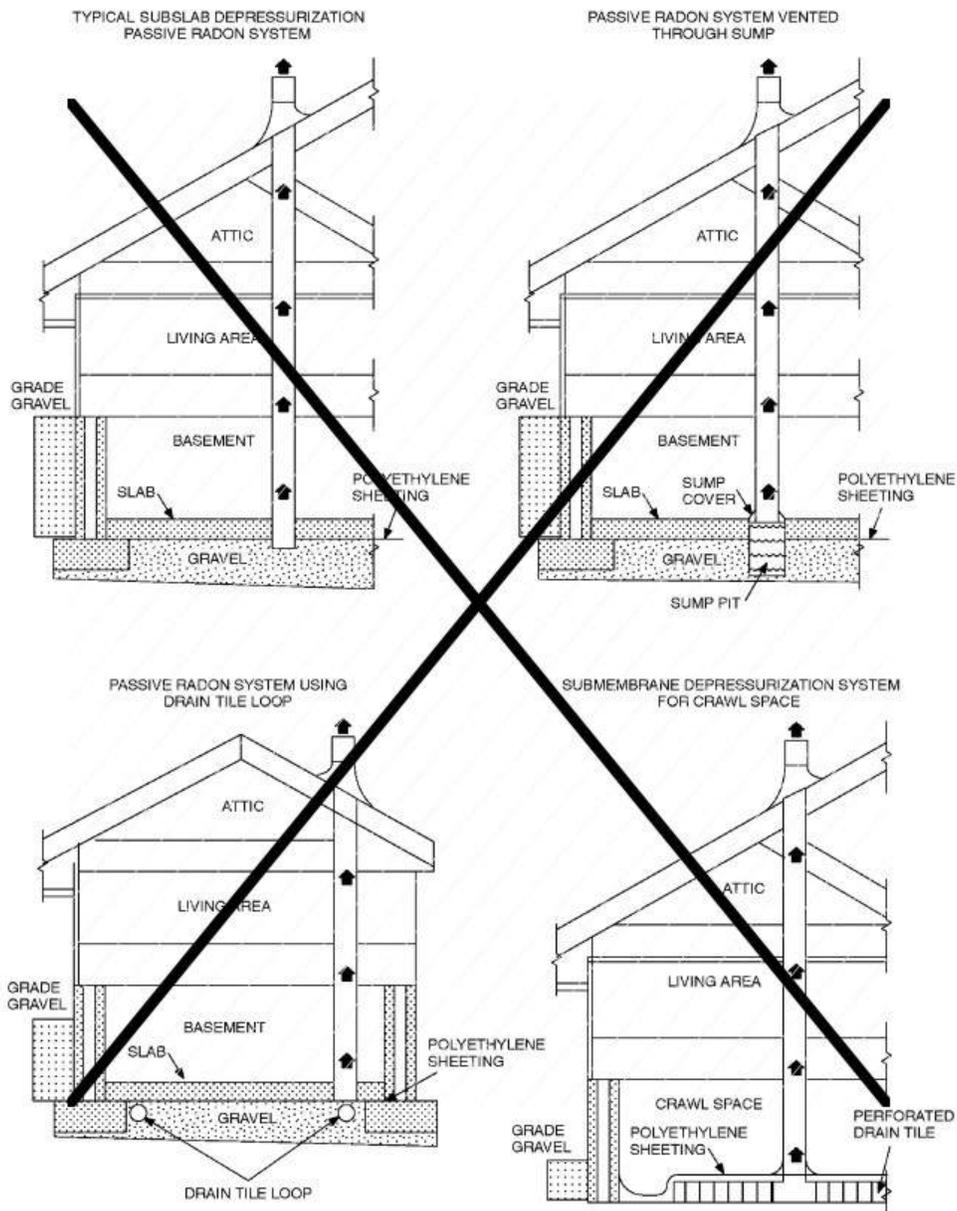
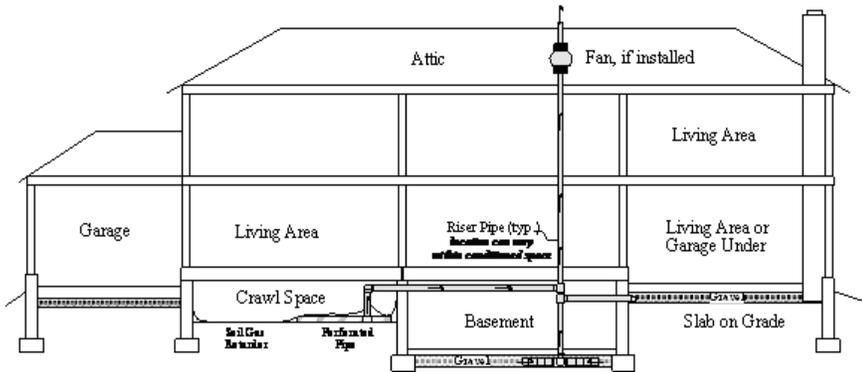


FIGURE AF103
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES



**FIGURE AF103.2
FOUNDATION TYPES**

Revise as follows:

~~AF103.6 AF103.3~~ **Passive sub-slab Sub-slab depressurization system- system rough-in.** In *basement* or slab-on-grade buildings, the following components of a ~~passive sub-slab sub-slab~~ depressurization system shall be installed during ~~construction- construction~~ in accordance with Sections AF103.3.1 through AF103.3 and AF103.5 through AF103.6.5.

Add new text as follows:

AF103.3.1 Gas Permeable Layer A gas-permeable layer shall be constructed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, not less than 4 inches [102 mm] in depth, shall be placed over the soil. The aggregate shall have a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33.
2. A uniform layer of native or fill sand, a minimum of 4 inches [102 mm] in depth, overlain by a layer or strips of geotextile drainage matting. The geotextile drainage matting shall have a cross-sectional area of at least 12 square inches [774 sq mm]. The closest edge of the geotextile matting shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.
3. A loop of 4 inch [102 mm] nominal or larger size perforated pipe placed in a trench along the perimeter of the foundation, with the trench backfilled with clean aggregate having a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33 such that the pipe is surrounded by aggregate for at least 1/3 of the outside pipe circumference. The pipe shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.
4. A loop of interconnected stay-in-place forms used to cast the foundation footing in accordance with 404.1.3.3.6 that is left in place to provide ground water control and provide a separate channel above the ground water channel for soil gas ventilation, with a cross sectional area no less than 12 square inches [77 sq. cm].
5. Other materials, systems or floor designs with demonstrated capability to allow the lateral flow of soil gases from across the entire sub-floor area.

AF103.3.2 Vent pipe connector. A 4 inch [102 mm] nominal diameter tee fitting or equivalent method shall be used to secure the vent pipe opening within the gas permeable layer. Not less than 4 feet [1219 mm] of perforated pipe or geotextile matting shall be connected to each of the two horizontal openings of the tee fitting or the two horizontal openings shall be connected to the interior drain tile system. Alternatively, a sealed sump cover where the sump communicates directly with the sub-slab aggregate or communicates with it through a drainage system, shall secure the vent pipe opening. A flexible rubber coupling connector shall be provided at the sump cover connection to facilitate servicing the sump.

Revise as follows:

~~AF103.3 AF103.3.3~~ **Soil-gas-retarder.** A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly ~~to serve as a soil gas-retarder by bridging any cracks that develop in the slab or floor assembly, and to prevent concrete from entering the void spaces in the aggregate base material.~~ The sheeting shall cover the entire floor area with separate sections of sheeting lapped not less than 12 inches (305 mm). ~~The sheeting shall fit closely around any mm) and extend up the surrounding foundation walls not less than 4 inches [101 mm].~~ Openings in the sheeting ~~caused by pipe, wire or and other penetrations of the material shall be sealed.~~ Punctures or tears in the material shall be sealed or covered with additional sheeting.

~~AF103.5 AF103.4~~ **Passive sub-membrane Sub-membrane depressurization system- system rough-in.** In buildings with a crawl space foundations ~~foundation~~, the following components of a ~~passive sub-membrane sub-membrane~~ depressurization system shall be installed during ~~construction- construction~~ in accordance with Sections AF103.4.1 through AF103.6.5.

Exceptions: Exception:

1. Buildings in which an *approved* mechanical crawl space ventilation system ~~or other equivalent system is installed.~~ is installed.
2. Where the soil gas retarder will be covered with concrete, the requirements of Section AF103.3.2 shall apply.

~~AF103.5.3 AF103.4.1 Vent pipe- pipe connector.~~ A plumbing tee or other ~~approved~~ connection fitting shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings. soil gas membrane with not less than 10 feet of perforated pipe connected to each of the two horizontal openings of such fitting or the two horizontal openings of the tee fitting shall connect to the interior drain tile system. The branch opening of the tee fitting shall be connected to the vent pipe in accordance with Section AF103.5.

~~AF103.5.2 AF103.4.2 Soil-gas retarder. Soil gas membrane.~~ The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil gas retarder. ~~The ground cover soil gas membrane complying with ASTM E1745 Class A, B or C.~~ The membrane shall be lapped not less than 12 inches (305 mm) at joints, and shall extend upwards 12 inches (305 mm) and be sealed to all foundation walls enclosing the crawl space area. Seams shall be sealed with polyurethane caulk complying with ASTM C920 class 25 or higher, or taped or equivalent method, installed in accordance with the manufacturer's recommendations.

~~AF103.6.1 AF103.5 Vent pipe.~~ A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent 3 inch [76 mm] nominal size or larger gas-tight pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.

~~The pipe shall be extended~~ extended from the tee fitting up through the building floors, in accordance with Sections AF103.5.1 through AF103.5.6. Materials used shall comply with Section P3002.1, and terminate not less than 12 inches (305 mm) above the surface of the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

~~AF103.5.1 Ventilation- Vent pipe termination.~~ Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Section R408.1.

The vent pipe shall terminate vertically upward not less than 12 inches [305 mm] above the roof and in a location not less than two feet [51 mm] vertically above, or not less than 10 feet [3048 mm] measured in any other direction, from openings in the building and adjacent buildings including windows, doors and other gravity air intake openings, exclusive of attic ventilation openings. Where a screen is installed on the terminus of radon exhaust pipe to prevent the entry of animals, such screen shall have a mesh size with a dimension of not less than 0.5 inch (12.7mm).

~~AF103.7 AF103.5.2 Vent pipe drainage.~~ Components of the ~~The radon vent pipe system~~ shall be installed to provide ~~positive condensate drainage~~ to the ground beneath the slab or ~~soil gas retarder membrane.~~ The pipe shall not be trapped and shall have a minimum slope of one-eighth inch per foot (1 percent slope).

~~AF103.9 AF103.5.3 Vent pipe identification.~~ Exposed and visible interior radon vent pipes shall be identified with not less than one label on each floor and in accessible ~~attics-attics.~~ The label shall read: ~~"Radon Reduction System."~~ "This pipe is a component of a radon control system. A radon test is necessary to verify that the radon level is below the level recommended by the US EPA." The height of the label lettering shall be not less than 0.25 inch [6.35 mm].

~~AF103.10 AF103.5.4 Combination foundations.~~ ~~Combination basement/crawl space or slab on grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected~~ Where more than one type of foundation is present, each foundation area shall have a separate radon vent pipe and soil gas collector. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

~~AF103.6.2 AF103.5.5 Multiple vent pipes- Separate foundation areas~~ In buildings where interior footings or other barriers separate the subslab aggregate or other gas permeable material ~~foundation areas,~~ each area shall be fitted with an individual vent pipe, pipe or a pipe loop or equivalent method shall connect such areas below the slab. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

Add new text as follows:

AF103.5.6 Provisions for radon fan. To facilitate possible installation of a radon fan, compliance with Sections AF103.5.6.1 through AF103.5.6.3 shall be required.

Revise as follows:

~~AF103.9 AF103.5.6.1 Vent pipe accessibility.~~ Radon vent pipes shall be accessible for future fan installation through provided with access in an attic or other area outside the *habitable space*. ~~Exception: The radon vent pipe need not be accessible in an attic space where an approved roof-top electrical supply is provided~~ for the purpose of installing a fan. The pipe shall be centered in an unobstructed cylindrical space having a vertical height of not less than 48 inches [122 cm] and a diameter of not less than 21 inches [53 cm] in the location where a fan would be installed.

Exception: Where an approved electrical supply is installed on the roof for future use.

Add new text as follows:

AF103.5.6.2 Radon fan location. Fans shall be located outdoors, in attics or in garages that are not beneath conditioned spaces. Fans shall not be installed below ground, in conditioned spaces, in occupiable spaces of a building or in any basement, crawlspace or other interior location that is directly beneath a conditioned or occupiable space of a building. Fans shall not be installed in any location where pipe positively pressured by the fan would be located inside conditioned or occupiable space.

Revise as follows:

~~AF103.12~~ **AF103.5.6.3 Power source. To provide for future installation of ~~an active submembrane or subslab depressurization system~~ a radon fan, an electrical circuit ~~terminated that terminates~~ in an approved junction box shall be installed ~~during construction~~ in the *attic* or other anticipated location of vent pipe fans. An electrical supply shall be accessible in anticipated locations of system failure alarms: a fan.**

~~AF103.4~~ **AF103.6 Entry routes. Potential radon entry routes shall be closed in accordance with Sections ~~AF103.4.1~~ AF103.6.1 through ~~AF103.4.10~~ AF103.6.5.**

~~AF103.4.1~~ **AF103.6.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires ~~or~~ and other objects that penetrate concrete slabs ~~, or other floor assemblies,~~ shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations: sealed in a permanent manner.
Exception: Sealing is not required for floors above conditioned spaces.**

~~AF103.4.2~~ **AF103.6.2 Concrete joints. ~~Control~~ Isolation joints, ~~isolation joints~~, construction joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk ~~or other elastomeric sealant applied~~ complying with ASTM C920 class 25 or higher or equivalent method installed in accordance with the manufacturer's recommendations.**

~~AF103.4.4~~ **AF103.6.3 Sumps. Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.**

~~AF103.4.5~~ **AF103.6.4 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of *solid masonry*, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent the passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks ~~or~~ and other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk complying with ASTM C920 class 25 or equivalent sealant: higher, or equivalent method installed in accordance with the manufacturer's recommendations. Penetrations of concrete walls shall be filled.**

~~AF103.4.10~~ **AF103.6.5 Crawl space access. Access doors and other openings or penetrations between *basements* and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.
Exception: Air sealing is not required for conditioned crawl spaces.**

Delete without substitution:

~~AF103.4.3 Condensate drains.~~ Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

~~AF103.4.6 Dampproofing.~~ The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section R406.

~~AF103.4.7 Air handling units.~~ Air handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

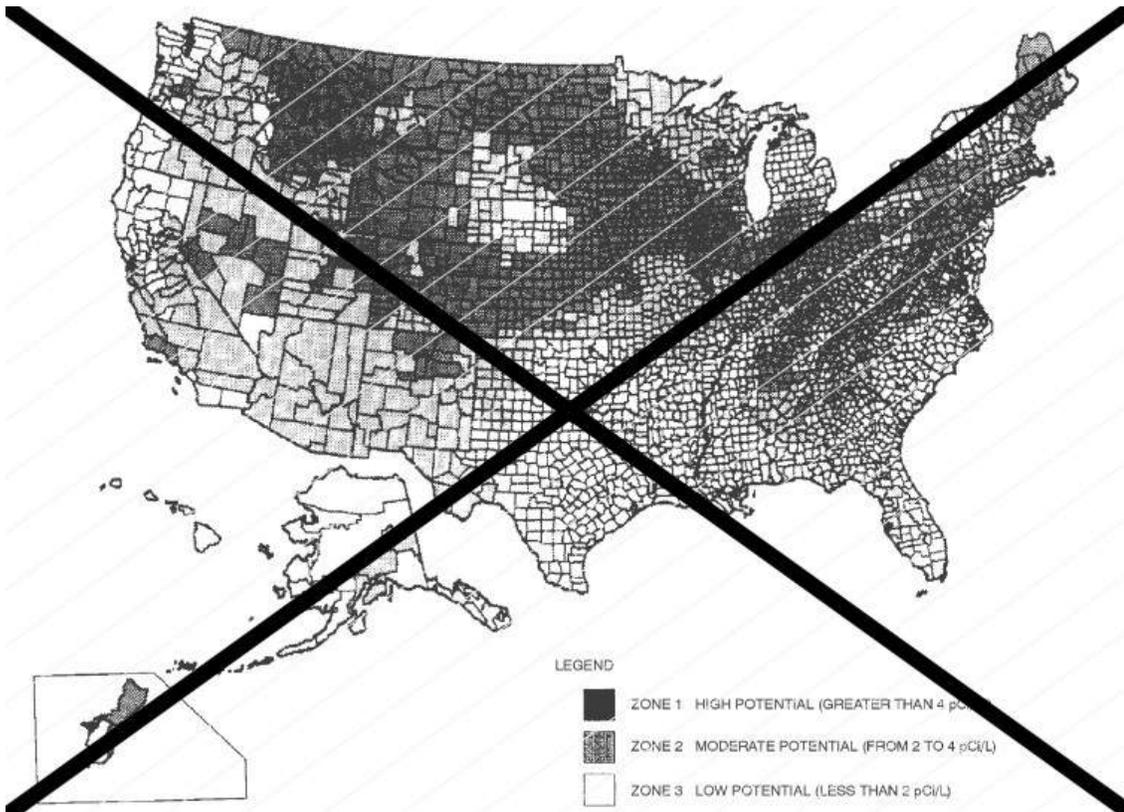
Exception: Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

~~AF103.4.8 Ducts.~~ Ductwork passing through or beneath a slab shall be of seamless material unless the air handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage.

Ductwork located in crawl spaces shall have seams and joints sealed by closure systems in accordance with Section M1601.4.1.

~~AF103.4.9 Crawl space floors.~~ Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

~~AF103.11 Building depressurization.~~ Joints in air ducts and plenums in *unconditioned spaces* shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.



a.pCi/L standard for picocuries per liter of radon gas. The U.S. Environmental Protection Agency (EPA) recommends that homes that measure 4 pCi/L and greater be mitigated.

The EPA and the U.S. Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist *building officials* in deciding whether radon-resistant features are applicable in new construction.

The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon control methods. The radon zone designation of highest priority is Zone 1. Table AF101 lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (EPA-402-R-93-021 through 070) available through State Radon Offices or from EPA Regional Offices.

**FIGURE AF101
EPA MAP OF RADON ZONES**

**TABLE AF101(1)
HIGH RADON-POTENTIAL (ZONE 1) COUNTIES***

Delete table in its entirety

~~a. The EPA recommends that this county listing be supplemented with other available State and local data to further understand the radon potential of a Zone 1 area.~~

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

Reason: This code change proposal improves Appendix F by clarifying some construction details, resolving longstanding editorial issues and addressing a few significant installation problems that impact the effectiveness of radon control in new construction.

The requirement subsections are renumbered to facilitate deletions of redundant material and reorganization. The narrative statement below refers to the subsection numbers in the *proposed* text.

- Additional detail has been provided on the vent pipe connector in Section AF103.3.3, the connection between the vertical radon vent pipe and the gas permeable layer below the crawl space or slab. This connection has suffered from consistent clogging with soil, concrete and/or gravel. A requirement for a couple of short lengths of perforated piping in the gas permeable layer and clarification that the tee fitting shall secure the vent pipe will largely prevent this clogging.
- Another latent problem which occurs often in the field is that the vent piping is routed through the attic space without allowing access to the vent pipe and leaving insufficient headroom for a fan if system activation is required. Space considerations are provided to address this problem in Section AF103.5.6. Fan installation remains outside of the scope of AF103.5.6.
- Section AF103.4.1, the required 12-inch lapping of joints is reduced to 6 inches, and extension of the soil gas retarder upward on foundation walls for subslabs is added to match the extension on walls for crawl spaces.
- Clearances to prevent radon entry from the exhaust pipe are clarified, and prevention of pipe obstruction by screening material is added, both within Section AF03.5.1.
- In Section AF103.5.3, the vent pipe identification is expanded to clarify the limit of Appendix F radon control.
- Lack of sealing of the submembrane soil gas retarder creates problems in systems installed in homes with crawl spaces. In this proposal, sealing is added (except for where the crawl space will be covered by concrete and where crawl space ventilation exists) to

Several editorial changes clarify and simplify the Appendix without expanding requirements. Along with some fairly self-explanatory edits, these changes include:

- Section AF101 specifies that the scope of the appendix is "radon control methods in new construction."
- Section AF101 would no longer include references to EPA radon zone 1, zone 1 county lists, or the EPA radon map. Voluntary use of the Appendix by builders and adoptions in jurisdictions beyond Zone 1 reduce the applicability of these materials. According to the Home Innovations Research Lab report "Radon-Resistant Construction Practices in New U.S. Homes 2016" [see bibliography] 24% of 2016 homes in Zone 2 were built with radon control. In 2016 the State of Connecticut adopted radon control for all counties; previously Minnesota and Illinois did the same. Local jurisdictions are adopting the Appendix.
- In AF102, the definition of radon gas is simplified, a universal term, radon rough-in, is added to clarify the type of system allowed by Appendix F, and duplicative references to active and passive subslab methods are deleted in favor of a single definition for subslab systems.
- In Section AF103.3.1 Gas Permeable Layer, an option for using stay-in-place forms per 404.1.3.3.6 is added to the choices, and the specification allowing for "the lateral flow of gases" is moved from the initial sentence to the fifth and final option.

- The description of materials for vent pipes in Section AF103.5 was changed from “ABS, PVC or equivalent” to “comply with P3002.1.”
- Redundancies with other code requirements for ventilation, foundation and condensate drains, damp proofing, and air handler sealing have been removed.
- An exception for sealing for floors above conditioned spaces is added in AF 103.6.1.
- Sealing requirements for control joints were eliminated in AF 103.6.2.

Most of the changes in this proposal were presented by the proponent in code change proposal or public comment in 2016.

Below for ease of review is the text that would result from the proposed revisions:

APPENDIX F

RADON CONTROL METHODS

AF101.1 General. This appendix contains requirements for radon control methods in new construction.

SECTION AF102 DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

RADON GAS. The element Rn-222, which is a radioactive, colorless, odorless, tasteless, cancer-causing gas that occurs naturally as a decay product of radium.

RADON ROUGH-IN. The installation of all parts and materials of submembrane or subslab depressurization system including gas permeable layers, soil gas retarders, membranes, piping, connectors, terminations, and power sources.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil [0.15 mm] polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SUBMEMBRANE DEPRESSURIZATION SYSTEM. System designed to achieve lower sub-membrane air pressure relative to crawl space air pressure by use of a fan powered vent drawing air from beneath the soil gas retarder membrane.

SUBSLAB DEPRESSURIZATION SYSTEM. System designed to achieve lower sub-slab air pressure by use of a fan-powered vent drawing air from beneath the floor slab.

SECTION AF103 REQUIREMENTS

AF103.1 General. AF103 is intended to reduce radon entry and prepare the building for post-construction radon mitigation if necessary.

AF103.2 Radon Rough-in. A rough-in is required for all foundation types, including crawlspace, basement, slab on grade, and slab on grade garage located below a living area as shown in Figure AF103.2. The rough-in shall be installed prior to pouring of concrete slabs, closure of building cavities, and installation of finish materials.

Figure AF103.2 Foundation Types

AF103.3 Sub-slab depressurization system rough-in. In basement or slab-on-grade buildings, the components of a sub-slab depressurization system shall be installed during construction in accordance with AF103.3.1 through AF103.3 and AF103.5 through AF103.6.5.

AF103.3.1 Gas permeable layer. A gas-permeable layer shall be constructed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building. The gas-permeable layer shall consist of one of the following:

A uniform layer of clean aggregate, not less than 4 inches [102 mm] in depth, shall be placed over the soil. The aggregate shall have a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33.

A uniform layer of native or fill sand, a minimum of 4 inches [102 mm] in depth, overlain by a layer or strips of geotextile drainage matting. The geotextile drainage matting shall have a cross-sectional area of at least 12 square inches [774 sq mm]. The closest edge of the geotextile matting shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.

A loop of 4 inch [102 mm] nominal or larger size perforated pipe placed in a trench along the perimeter of the foundation, with the trench backfilled with clean aggregate having a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33 such that the pipe is surrounded by aggregate for at least 1/3 of the outside pipe circumference. The pipe shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.

A loop of interconnected stay-in-place forms used to cast the foundation footing in accordance with 404.1.3.3.6 that is left in place to provide ground water control and provide a separate channel above the ground water channel for soil gas ventilation, with a cross sectional area no less than 12 square inches [77 sq. cm].

Other materials, systems or floor designs with demonstrated capability to allow the lateral flow of soil gases from across the entire sub-floor area.

AF103.3.2 Vent pipe connector. A 4 inch [102 mm] nominal diameter tee fitting or equivalent method shall be used to secure the vent pipe opening within the gas permeable layer. Not less than 4 feet [1219 mm] of perforated pipe or geotextile matting shall be connected to each of the two horizontal openings of the tee fitting or the two horizontal openings shall be connected to the interior drain tile system. Alternatively, a sealed sump cover where the sump communicates directly with the sub-slab aggregate or communicates with it through a drainage system, shall secure the vent pipe opening. A flexible rubber coupling connector shall be provided at the sump cover connection to facilitate servicing the sump.

AF103.3.3 Soil gas retarder. A minimum 6-mil [.006 in; 0.15 mm] (or 3-mil [.003 in; 0.075 mm] cross-laminated) polyethylene or equivalent flexible sheeting material shall be placed on top of the gas permeable layer prior to casting the slab or placing the floor assembly. The sheeting shall cover the entire floor area with separate sections of sheeting lapped not less than 12 inches [305 mm] and extend up the surrounding foundation walls not less than 4 inches [101 mm]. Openings in the sheeting caused by pipe, wire and other penetrations shall be sealed. Punctures or tears in the material shall be sealed or covered with additional sheeting.

AF103.4 Sub-membrane depressurization system rough-in. In buildings with a crawl space foundation, the components of a sub-membrane depressurization system shall be installed during construction in accordance with AF103.4.1

through AF103.6.5.

Exceptions:

Buildings in which an approved mechanical crawl space ventilation system is installed.

Where the soil gas retarder will be covered with concrete, the requirements of 103.3.2 shall apply.

AF103.4.1 Vent pipe connector. A tee fitting shall be installed beneath the soil gas membrane with not less than 10 feet of perforated pipe connected to each of the two horizontal openings of such fitting or the two horizontal openings of the tee fitting shall connect to the interior drain tile system. The branch opening of the tee fitting shall be connected to the vent pipe in accordance with section AF103.5.

AF103.4.2 Soil gas membrane. The soil in crawl spaces shall be covered with a continuous layer of soil gas membrane complying with ASTM E1745 Class A, B or C. The membrane shall be lapped not less than 6 inches [152 mm] at joints and shall extend upwards 12 inches [305 mm] and be sealed to all foundation walls enclosing the crawl space area. Seams shall be sealed with polyurethane caulk complying with ASTM C920 class 25 or higher, or taped or equivalent method, installed in accordance with the manufacturer's recommendations.

AF103.5 Vent pipe. A 3 inch [76 mm] nominal size or larger gas-tight pipe shall be extended from the tee fitting up through the building floors and in accordance with Sections AF103.5.1 through AF103.5.6. Materials used shall comply with P3002.1.

AF103.5.1 Vent pipe termination. The vent pipe shall terminate vertically upward not less than 12 inches [305 mm] above the roof and in a location not less than two feet [51 mm] vertically above, or not less than 10 feet [3048 mm] measured in any other direction from, openings in the building and adjacent buildings including windows, doors and other gravity air intake openings, exclusive of attic ventilation openings. Where a screen is installed on the terminus of radon exhaust pipe to prevent the entry of animals, such screen shall have a mesh size with a dimension of not less than 0.5 inch (12.7mm).

AF103.5.2 Vent pipe drainage. The radon vent pipe shall be installed to provide condensate drainage to the ground beneath the slab or membrane. The pipe shall not be trapped and shall have a minimum slope of one-eighth inch per foot (1 percent slope).

AF103.5.3 Vent pipe identification. Exposed and visible interior radon vent pipes shall be identified with not less than one label on each floor and in accessible attics. The label shall read "This pipe is a component of a radon control system. A radon test is necessary to verify that the radon level is below the level recommended by the US EPA." The height of the label lettering shall be not less than 0.25 inch [6.35 mm].

AF103.5.4 Combination foundations. Where more than one type of foundation is present, each foundation area shall have a separate radon vent pipe and soil gas collector. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.5.5 Separate foundation areas. In buildings where interior footings or other barriers separate foundation areas, each area shall be fitted with an individual vent pipe or a pipe loop or equivalent method shall connect such areas below the slab. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.5.6 Provisions for radon fan. To facilitate possible installation of a radon fan, the following shall be provided:

AF103.5.6.1 Vent pipe accessibility. The radon vent pipes shall be provided with access in an attic or other area outside the habitable space for the purpose of installing a fan. The pipe shall be centered in an unobstructed cylindrical space having a vertical height of not less than 48 inches [122 cm] and a diameter of not less than 21 inches [53 cm] in the location where a fan would be installed.

Exception: Where an approved electrical supply is installed on the roof for future use.

AF103.5.6.2 Radon fan location. Fans shall be located outdoors, in attics or in garages that are not beneath conditioned spaces. Fans shall not be installed below ground, in conditioned spaces, in occupiable spaces of a building or in any basement, crawlspace or other interior location that is directly beneath a conditioned or occupiable space of a building. Fans shall not be installed in any location where pipe positively pressured by the fan would be located inside conditioned or occupiable space.

AF103.5.6.3 Power source. To provide for future installation of a radon fan, an electrical circuit that terminates in an approved junction box shall be installed in the attic or other anticipated location of a fan.

AF103.6 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.6.1 through AF103.6.5.

AF103.6.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires and other objects that penetrate concrete slabs or floor assemblies shall be sealed in a permanent manner.

Exception: Sealing is not required for floors above conditioned spaces.

AF103.6.2 Concrete joints. Isolation joints, construction joints and other joints in concrete slabs and between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk complying with ASTM C920 class 25 or higher or equivalent method installed in accordance with the manufacturer's recommendations.

AF103.6.3 Sumps. Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as a suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

AF103.6.4 Foundation walls. Hollow block masonry foundation walls shall be constructed with a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished grade to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks and other openings around penetrations of both exterior and interior surfaces of masonry block and wood foundation walls below the ground surface shall be filled with polyurethane caulk complying with ASTM C920 class 25 or higher, or equivalent method installed in accordance with the manufacturer's recommendations. Penetrations of concrete walls shall be sealed.

AF103.6.5 Crawl space access. Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

Exception: Air sealing is not required for conditioned crawl spaces.

Bibliography: "Radon-Resistant Construction Practices in New U.S. Homes 2016," prepared by Home Innovations Research Lab, Annual Builder Practices Survey, 5960-17, for USEPA.

Cost Impact: The code change proposal will increase the cost of construction

The additional cost of the code change in materials is \$25: \$10 for 10 feet of 4" perforated pipe; \$10 for caulk to seal the soil gas retarder and \$5 in additional cost for soil retarder material on walls (offset by the reduction in soil retarder material needed to overlap seams). There is also a labor cost component which is minimal for the perforated pipe and variable for the sealing depending on the area of the crawl space.

Installation of the existing Appendix F in a single family home is documented in the Home Innovation Research Labs' 2016 report on radon-resistant construction practices [see bibliography]: "In 2016, the average installation cost for a passive system in a single-family detached home was approximately \$374, up slightly from the \$358 reported for 2015 and \$332 reported for 2014."

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E1745, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB288-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee does not want to remove the map and is not in favor of the language in AF101.1. That struck language gave departments guidance on when to deal with Zone 1 requirements. The map is a key component, especially when jurisdictions are considering adoption of the appendix. AF103.5.6.2 being added would conflict with previous action. (Vote: 11-0)

Assembly Action:

None

RB288-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org)

requests As Submitted

Commenter's Reason: The reasons stated in the code change proposal remain relevant.

Additional statement in response to the reported committee reason for disapproval:

All over the US, builders are installing radon control systems in counties classified as Zone 1, 2 and 3. In 2016, 24% of Zone 2 homes had radon systems installed. Radon systems outside of Zone 1 should be subject to code official oversight for compliance with Appendix F. The methods apply regardless of radon zone.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The additional cost of the code change in materials is \$25: \$10 for 10 feet of 4" perforated pipe; \$10 for caulk to seal the soil gas retarder and \$5 in additional cost for soil retarder material on walls (offset by the reduction in soil retarder material needed to overlap seams). There is also a labor cost component which is minimal for the perforated pipe and variable for the sealing depending on the area of the crawl space.

Public Comment# 1972

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Residential Code

Add new text as follows:

AF104 Testing. Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test
2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating
3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately
4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen
5. Testing shall be performed with a commercially available radon test kit or with a continuous radon monitor that can be calibrated. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing device manufacturer's instructions
6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for at least 12 hours prior to the testing
7. Testing shall be performed by the builder, a registered design professional, or an approved third party.
8. Testing shall be conducted over a period of not less than 48 hours or not less than the period specified by the testing device manufacturer, whichever is longer
9. Written radon test results shall be provided by the test lab or testing party. The final written test results shall be included with construction documents.
10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.8 and AF103.12
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

Exception: Testing is not required where the occupied space is located above an unenclosed open space.

Reason: Testing is the only way to know if radon levels are below the safety level. Radon is a tasteless colorless gas that can cause lung cancer. Radon tests are relatively simple and inexpensive. The jurisdiction decides if radon-resistant construction applies in the jurisdiction by adopting (or not adopting) Appendix F, most commonly adopting the Appendix F in radon zone 1. Both the occupants and the builder want to know that the radon mitigation system works.

Where radon systems are required, consider this test commissioning for the radon system. Typically the inexpensive radon test kits are mailed off to a testing lab. The testing lab responds fairly quickly with written results. The "safety" level or range is a test below 4 pCi/L. Besides confirming compliance, written test results provide the owner with confirmation the home's radon level is at or below the safety level. For unsold homes, written test results with the construction documents allow the future owner to know that the home passed its safety test.

Often homes will pass without installing the fan described in Appendix F, with is sometimes called a "passive" radon system. Where a passive system does not meet the safety level, adding a fan usually lowers the radon level to the safety range.

Bibliography: The American Cancer Society states that "The leading cause of lung cancer in non-smokers is exposure to radon gas." (ref 1) The link between radon and lung cancer has been firmly established for about 20 years (ref 2). Radon is estimated to cause about 20,000 deaths per year from lung cancer (ref 2). Children exposed to high levels of radon are more likely to develop lung cancer later in life. (ref 3). Deaths from radon significantly exceed deaths from other building-related risks; such as fires, falls, electrocution, tornadoes, hurricanes, winds, fires, etc. In part this is because the codes have reduced these other risks, but have not addressed radon as well.

1) Lung Cancer Risks for Non-Smokers. American Cancer Society. Nov 6, 2017 <https://www.cancer.org/latest-news/why-lung-cancer-strikes-nonsmokers.html>

Radon "accounts for about 21,000 deaths from lung cancer each year."

2) U.S. National Research Council Committee on the Biological Effects of Ionizing Radiation. 1999.

<https://www.nap.edu/read/5499/chapter/1#viii> <https://www.nap.edu/read/5499/chapter/5#97>

Historically the link between radon and lung cancer was not understood. Radon is an invisible, tasteless and odorless gas. There is a long period between exposure to radon and the symptoms of lung cancer. Recognition that radon increased lung cancers came from early studies of uranium miners, and was later confirmed more broadly.

<https://www.nap.edu/read/5499/chapter/5#97>

In 1999 it was concluded that residential radon, as well as smoking, were the most important contributors to the lung cancer. Note table 3-10, summed "total male" and "total female" for both "ever-smokers" and "never-smokers" Actual value in table is 21,800, but is rounded to 21,000.

3) "Canadian Lung Cancer Relative Risk from Radon Exposure for Short Periods in Childhood Compared to a Lifetime" International Journal of Environmental Research and Public Health. 2013 May; 10(5): 1916–1926.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3709356/>

The study concluded: "... exposure to radon during childhood increases the lifetime risk of developing lung cancer ... if a child lived in a home with very high radon concentration for only a few years, the risk of developing lung cancer later in the life could be equivalent to a lifetime exposure to moderate radon concentration."

Cost Impact: The code change proposal will increase the cost of construction

Radon test kits are inexpensive, less than \$50 for the two tests including laboratory determination of results. Tests by radon professionals will likely be more expensive.

RB289-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Continuous radon monitor testing must be maintained, but this is lacking. There are concerns regarding test kits from retailers. We usually have a standard for a test. The result should not go to the building official. That said, the committee feels the proponent is onto something and should continue this work and submit a public comment. (Vote: 7-4)

Assembly Action:

None

RB289-19

Individual Consideration Agenda

Public Comment 1:

IRC@: AF104 (New)

Proponents:

Craig Conner, representing self (craig.conner@mac.com); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc.; Ruth Mcburney, representing Conference of Radiation Control Program Directors (rmcburney@crccd.org); Aaron S Johnson, US EPA, representing US EPA (johnson.aarons@epa.gov); Janise Stolarova, representing USEPA (stolarova.janise@epa.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF104 Testing. Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test
2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating
3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately
4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen
5. Testing shall be performed with a commercially available radon test kit or testing shall be performed by an approved third party with a continuous radon monitor ~~that can be calibrated~~. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit device manufacturer's instructions
6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for at least 12 hours prior to the testing
7. Testing shall be performed by the builder, a registered design professional, or an approved third party.
8. Testing shall be conducted over a period of not less than 48 hours or not less that the period specified by the testing device manufacturer,

whichever is longer

9. Written radon test results shall be provided by the test lab or testing party. The final written test ~~results report with results less than 4 pCi/L shall be included with construction documents provided to the code official.~~
10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.8 and AF103.12
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

Exception: Testing is not required where the occupied space is located above an unenclosed open space.

Commenter's Reason:

All who testified against the original proposed change are co-proponents of this public comment. This comment incorporates the results of discussions both at and after the hearing. The committee suggested a public comment.

Radon systems need to be tested. Nobody can see, hear, taste, or feel radon. Soil under residences can contain high levels of radon. Construction specified in Appendix F is intended to limit radon entering the residence, but testing is the only way to know if a radon system works. Testing functions as commissioning for radon systems.

This comment clarifies the radon testing language. The comment clarifies that test kit instructions are in addition to the requirements of the section. In practice most will test using radon test kits; however, radon professionals may choose to use continuous radon monitors. Both types of testing are allowed.

This comment specifies a report showing radon results below EPA's "action level" (4 pCi/l). If initial test results shows a high radon level, items #10 and #11 require modifications and retesting to achieve the lower radon level. Modifications include activating the vent fan described in the existing Appendix F.

Please approve this public comment to add a radon test to verify radon systems work.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Radon test kits are inexpensive, less than \$50 for the two tests including laboratory determination of results.

Public Comment# 1440

RB291-19

IRC@: AK102.1, AK103.1, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Tim Earl, representing The Gypsum Association (tearl@gbhinternational.com)

2018 International Residential Code

Revise as follows:

AK102.1 General. Airborne sound insulation for wall and floor-ceiling assemblies shall meet a sound transmission class (STC) rating of 45 where tested in accordance with ASTM E90 or an apparent STC (ASTC) of 42 when tested in accordance with ASTM ~~E90-E336~~. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. *Dwelling unit* entrance doors, which share a common space, shall be tight fitting to the frame and sill.

AK103.1 General. Floor/ceiling assemblies between *dwelling units*, or between a *dwelling unit* and a public or service area within a structure, shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM ~~E492-E492~~ or an apparent IIC (AIIC) of 42 where tested in accordance with ASTM E1007.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E336-17a: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1007-16: Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

Reason: This creates the addition of the option for field testing for ASTC and AIIC – actual field measures versus laboratory measures - with slightly lower requirements for these versus the lab tested assemblies as they are actual numbers of in place systems. This begins to migrate the code to the more preferred field verified apparent measures as reflected in ICC G2-2010 guidance, in the IBC and in ASTM standards on sound, but still leaves it as just an option in an optional appendix.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This adds an optional method of testing, so it will not increase the cost of construction unless users choose this option, which would add approximately \$1,500 to the cost of a home.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM E336-17a and E1007-16, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB291-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: A public comment to address the proposed modification may be in order. (Vote: 11-0)

Assembly Action:

None

RB291-19

Individual Consideration Agenda

Public Comment 1:

IRC@: AK102.1, AK103.1, ASTM Chapter 44 (New)

Proponents:

Samantha Rawlings, representing Veneklasen Associates (srawlings@veneklasen.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AK102.1 General. Airborne sound insulation for wall and floor-ceiling assemblies shall meet a sound transmission class (STC) rating of 45 where tested in accordance with ASTM E90 or a Normalized Noise Isolation Class (NNIC) rating ~~an apparent STC (ASTC)~~ of 42 when tested in accordance with ASTM E336. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. *Dwelling unit* entrance doors, which share a common space, shall be tight fitting to the frame and sill.

AK103.1 General. Floor/ceiling assemblies between *dwelling units*, or between a *dwelling unit* and a public or service area within a structure, shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492 or a Normalized Impact Sound Rating (NISR) ~~an apparent IIC (AIIIC)~~ of 42 where tested in accordance with ASTM E1007.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E336-17a: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1007-16: Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

Commenter's Reason: The proposed change adds references to the correct field test standards and mirrors the IBC language to maintain consistency between the codes.

This change was proposed at the committee action hearings but the modification was ruled out-of-order. The committee expressed support of the floor modification and suggested proponents resubmit as a public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed change only clarifies code requirements and maintains consistency with the IBC code language. There is no cost impact.

Public Comment# 1848

RB292-19

IRC@: AQ (New), AQ106.1 (New), AQ106.1.1 (New), AQ107.1 (New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Residential Code

Add new text as follows:

AQ Energy Conservation

AQ106.1 Testing for tiny houses. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 pascals of pressure per ft² of the dwelling unit enclosure area.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where an air leakage rate not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area in accordance with Section AQ106.1 is provided, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

AQ107.1 Tiny House. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.
4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section R404.
6. Mechanical ventilation is provided in accordance with Section M1505 of this code. Operable fenestration is not used for ventilation.

Reason: The appendix currently states that tiny houses must comply with the code except for the following. There are some energy requirements that need to be adjusted for the unique construction of tiny houses. The current test parameters for air tightness are not conducive for houses with smaller volumes. The new testing parameters and metrics will provide the ability for air leakage of the smaller structures and allowing for them to demonstrate compliance.

When testing to the new metrics there needs to be an understanding that when meeting the testing one must provide a whole house mechanical ventilation system.

This proposal addresses those tiny houses that build to be self-sufficient with their energy consumption. If they meet those requirements they should be considered to comply with the intent of the energy requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

These requirements while are already required would not increase the cost of construction. This proposal provide options for the type of construction that happens for tiny houses to obtain energy compliance.

RB292-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

SECTION AQ106 **Energy Conservation**

AQ106.1 Testing for tiny houses Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 ~~pascals~~ Pascals of pressure per ft² of the dwelling unit enclosure area.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where an air leakage rate not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area in accordance with Section AQ106.1 is provided, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

~~AQ107.1 Tiny House~~ AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.
4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section R404.
6. Mechanical ventilation is provided in accordance with Section M1505 of this code. Operable fenestration is not used for ventilation.

Committee Reason: Compliance with the code is required with the exception of what is in the appendix. This helps to regulate tiny house construction. The titles in the modification make much more sense. (Vote: 10-1)

Assembly Action:

None

RB292-19

Individual Consideration Agenda

Public Comment 1:

IRC@: SECTION AQ106 (New), AQ106.1 (New), AQ106.1.1 (New), AQ106.2 (New)

Proponents:

Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Thom Stanton, representing Tiny Home Industry Association (THIA) (gotiny.com@gmail.com); Brad Wiseman, representing Tiny Home Industry Association (chairman@tinyhomeindustryassociation.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

SECTION AQ106 Energy Conservation

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per ft² of the dwelling unit enclosure area. The dwelling unit enclosure area shall be the sum of the areas of ceilings, floors, and walls that separate the conditioned space of a dwelling unit from the exterior, its adjacent unconditioned spaces, and adjacent dwelling units.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior ~~doors or interior terminations~~ for continuous ventilation systems ~~and heat recovery ventilators~~ shall be ~~closed and~~ sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where ~~an the~~ air leakage rate ~~not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area~~ is in accordance with Section AQ106.1 ~~is provided~~, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.
4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section ~~R404~~ N1104.
6. Mechanical ventilation is provided in accordance with Section M1505 ~~of this code~~. Operable and operable fenestration is not used ~~for to~~ meet ventilation requirements.

Commenter's Reason: This public comment does the following:

- Defines "dwelling unit enclosure area", which was absent. Uses language consistent with the source definition from ASHRAE 62.2-2016, and editorial changes to definitions of this term in public comments to proposals RE88 and RE92.
- Corrects item 4 under "During testing:" in Section AQ106.1, which was from the 2015 IRC, not the 2018 IRC

- Simplifies and reduces the language in Section AQ106.1.1 without changing its meaning
- Replaces IECC number R404 in Section AQ106.2 item 5 with the more appropriate IRC section number N1104 (the content of these sections is identical)
- Simplifies and clarifies the language in item 6 in Section AQ106.2

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The requirements in the proposal are already required in the IRC and would not increase the cost of construction. The proposal, along with the modifications in the public comment, simply provides options for tiny houses to meet those requirements and obtain energy compliance.

Public Comment# 1617

Public Comment 2:

IRC@: SECTION AQ106 (New), AQ106.1 (New), AQ106.1.1 (New), AQ106.2 (New)

Proponents:

Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David A Eisenberg, DCAT, representing DCAT (strawnet@gmail.com); Brad Wiseman, representing Tiny Home Industry Association (chairman@tinyhomeindustryassociation.org); Thom Stanton, representing Tiny Home Industry Association (THIA) (gotiny.com@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

SECTION AQ106 Energy Conservation

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per ft² of the dwelling unit enclosure area. ~~The air leakage testing shall be in accordance with the testing methods required in Section N1102.4.1.2. The dwelling unit enclosure area shall be the sum of the areas of ceilings, floors, and walls that separate the conditioned space of a dwelling unit from the exterior, its adjacent unconditioned spaces, and adjacent dwelling units. Testing shall be conducted in accordance with RESNET/IGC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.~~

During testing:

- ~~1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.~~
- ~~2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.~~
- ~~3. Interior doors, if installed at the time of the test, shall be open.~~
- ~~4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.~~
- ~~5. Heating and cooling systems, if installed at the time of the test, shall be turned off.~~
- ~~6. Supply and return registers, if installed at the time of the test, shall be fully open.~~

AQ106.1.1 Whole house mechanical ventilation. Where ~~an~~ the air leakage rate not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area ~~is~~ in accordance with Section AQ106.1 ~~is provided~~, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.

4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section ~~R404~~ N1104.
6. Mechanical ventilation is provided in accordance with Section M1505 of this code. ~~Operable and operable~~ fenestration is not used ~~for to~~ meet ventilation requirements.

Commenter's Reason: This public comment:

- Defines "dwelling unit enclosure area", which was absent. Uses language consistent with the source definition from ASHRAE 62.2-2016, and editorial changes to definitions of this term in public comments to proposals RE88 and RE92.
- Removes language that is duplicated verbatim in IRC Section N1102.4.1.2, and instead references that section
- Simplifies and reduces the language in Section AQ106.1.1 without changing its meaning
- Replaces IECC number R404 in Section AQ106.2 item 5 with the more appropriate IRC section number N1104 (the content of these sections is identical)
- Simplifies and clarifies the language in item 6 in Section AQ106.2

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The requirements in the proposal are already required in the IRC and would not increase the cost of construction. The proposal, along with the modifications in the public comment, simply provides options for tiny houses to meet those requirements and obtain energy compliance.

Public Comment# 1939

Public Comment 3:

IRC@: AQ106.1 (New), AQ106.1.1 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per ft² of the dwelling unit enclosure area.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior or interior terminations ~~doors~~ for continuous ventilation systems ~~and heat recovery ventilators~~ shall be closed ~~and~~ sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where an air leakage rate ~~not exceeding~~ is 0.30 cfm per ft² of the dwelling unit enclosure area or less in accordance with Section AQ106.1 ~~is provided~~, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

Commenter's Reason: the public comment is to address a couple of items that came to my attention. Number 4 of the During testing portion of

AQ106.1 utilized the 2015 wording and not the 2018 wording, which is what my original intent was for this proposal. The original wording of AQ106.1.1 felt a bit awkward, so I corrected it.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. These items were already required.

Public Comment# 2052

RB299-19

IRC@: APPENDIX U (New), SECTION AU101 (New), AU101.1 (New), AU101.2 (New), AU101.3 (New), AU101.4 (New), FIGURE AU101.4 (New), SECTION AU102 (New), AU102.1 (New), SECTION AU103 (New), AU103.1 (New), AU103.2 (New), AU103.3 (New), AU103.4 (New), AU103.4.1 (New), AU103.5 (New), AU103.6 (New), AU103.7 (New), AU103.8 (New), AU103.9 (New), SECTION AU104 (New), AU104.1 (New), AU104.2 (New), AU104.3 (New), AU104.4 (New), AU104.4.1 (New), AU104.4.2 (New), AU104.4.3 (New), AU104.4.3.1 (New), AU104.4.3.2 (New), AU104.4.4 (New), AU104.4.5 (New), AU104.4.6 (New), AU104.4.7 (New), AU104.4.8 (New), AU104.4.9 (New), SECTION AU105 (New), AU105.1 (New), AU105.2 (New), AU105.3 (New), AU105.3.1 (New), TABLE AU105.3 (New), AU105.3.2 (New), AU105.3.3 (New), AU105.3.4 (New), AU105.3.4.1 (New), AU105.3.4.2 (New), AU105.3.4.3 (New), AU105.3.5 (New), AU105.4 (New), AU105.4.1 (New), AU105.4.2 (New), AU105.4.3 (New), AU105.4.4 (New), AU105.4.5 (New), AU105.5 (New), SECTION AU106 (New), AU106.1 (New), AU106.2 (New), AU106.3 (New), AU106.4 (New), AU106.5 (New), AU106.6 (New), AU106.6.1 (New), AU106.7 (New), AU106.7.1 (New), AU106.8 (New), AU106.8.1 (New), AU106.8.2 (New), AU106.9 (New), AU106.9.1 (New), AU106.9.1.1 (New), AU106.9.1.2 (New), AU106.9.1.3 (New), AU106.9.2 (New), AU106.9.3 (New), AU106.9.4 (New), AU106.9.5 (New), AU106.9.6 (New), AU106.10 (New), TABLE AU106.10 (New), AU106.11 (New), AU106.11.1 (New), AU106.11.2 (New), AU106.11.3 (New), FIGURE AU106.11.3 (New), TABLE AU106.11(1) (New), TABLE AU106.11(2) (New), TABLE AU106.11(3A) (New), AU106.11(3B) (New), AU106.11(3C) (New), AU106.12 (New), TABLE AU106.12 (New), AU106.13 (New), AU106.14 (New), SECTION AU107 (New), AU107.1 (New), SECTION AU108 (New), AU108.1 (New), AU108.2 (New), SECTION AU109 (New), AU109.1 (New), AU109.2 (New), AU109.3 (New), SECTION AU110 (New)

Proposed Change as Submitted

Proponents: Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); john fordice, representing cob research institute (otherfish@comcast.net); Michael Smith, representing Cob Research Institute (michael@strawclaywood.com); Art Ludwig, representing Oasis Design (art@oasisdesign.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Anthony Dente, representing Verdant Structural Engineers (anthony@verdantstructural.com); David Rich, Reax Engineering Inc., representing Reax Engineering Inc. (rich@reaxengineering.com); Kevin Donahue, representing Kevin Donahue Structural Engineer (kevin@verdantstructural.com); Ben Loescher, representing Self (bloescher@lmarchitectsinc.com)

2018 International Residential Code

Add new text as follows:

APPENDIX U **Cob Construction (Monolithic Adobe)** **SECTION AU101** **GENERAL**

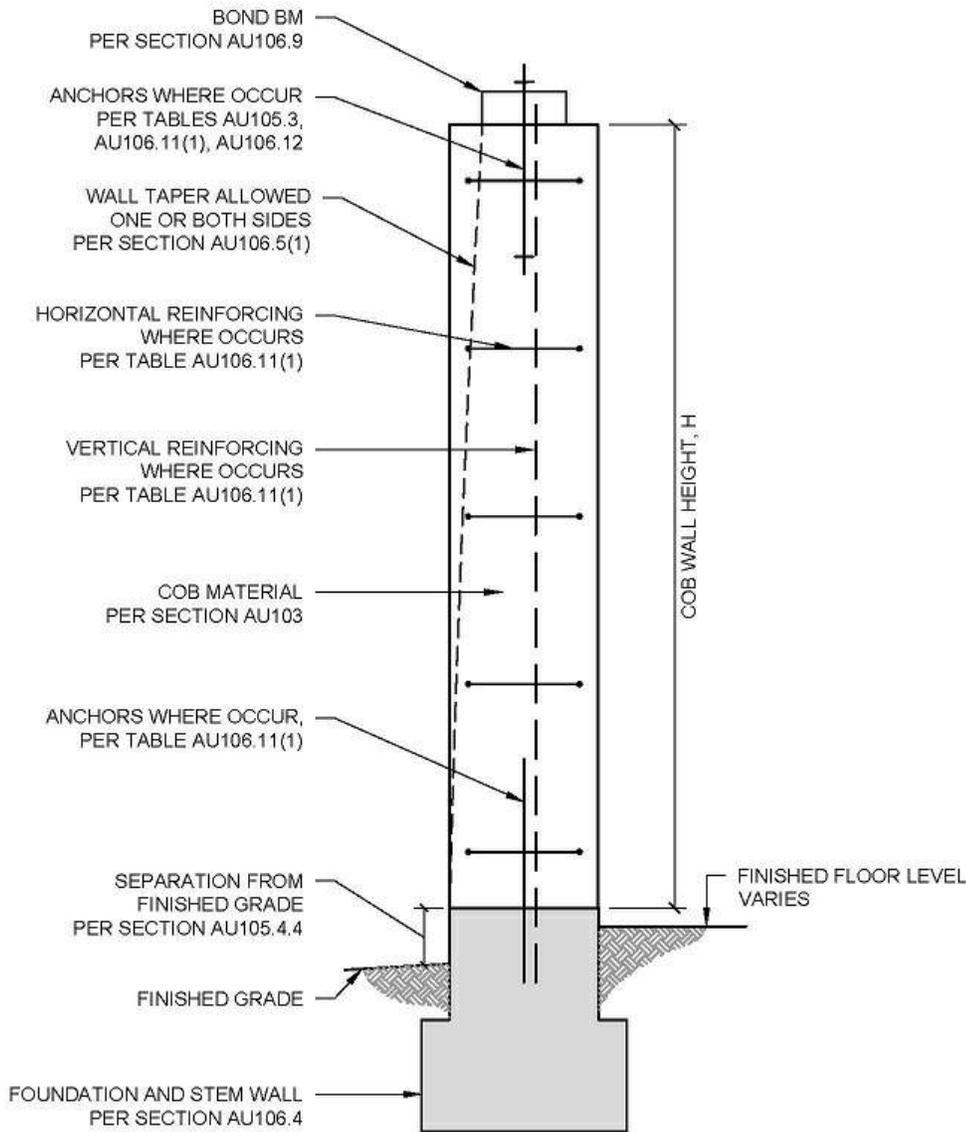
AU101.1 Scope. This appendix provides prescriptive and performance-based requirements for the use of *natural cob* as a building material. *Buildings* using *cob* walls shall comply with this code except as otherwise stated in this appendix.

AU101.2 Intent. In addition to the intent described in Section R101.3, the purpose of this appendix is to establish minimum requirements for cob structures that provide flexibility in the application of certain provisions of the code, to permit the use of site-sourced and local materials, and innovative combinations of proven historical and modern techniques that are safe, reduce life-cycle impacts, and increase affordability.

AU101.3 Tests and empirical evidence. Tests for an alternative material, design or method of construction shall be in accordance with Section R104.11.1, and the *building official* shall have the authority to consider evidence of a history of successful use in lieu of testing.

AU101.4 Cob wall systems. *Cob* wall systems include those shown in Figure AU101.4 and *approved* variations.

FIGURE AU101.4 TYPICAL COB WALL



SECTION AU102 **DEFINITIONS**

AU102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *International Residential Code* for general definitions.

BRACED WALL PANEL. A cob wall designed and constructed to resist in-plane shear loads through the interaction of the cob material, its reinforcing and its connections to its bond beam and foundation. The panel's length meets the requirements for the particular wall type and contributes toward the total amount of bracing required along its braced wall line in accordance with Sections AU106.11 and R602.10.1.

BUTTRESS. A mass set at an angle to, or bonded to a wall that it strengthens or supports.

CLAY. Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity, used as the binder of other component materials in a mix of cob or of clay plaster.

CLAY SUBSOIL. Subsoil sourced directly from the earth, containing clay, sand, and silt, and not more than trace amounts of organic matter.

COB. A composite building material consisting of refined clay or clay subsoil wet-mixed with loose straw and sometimes sand. Also known as *monolithic adobe*.

COB CONSTRUCTION. A wall system of layers or *lifts* of moist *cob* placed to create monolithic walls, typically without formwork.

DRY JOINT. The boundary between a layer of moist cob and a previously laid and significantly drier, non-malleable layer of cob that requires wetting to achieve bonding between the layers.

FINISH. Completed combination of materials on the face of a *cob* wall.

LIFT. A layer of installed *cob*.

LOAD-BEARING WALL. A *cob* wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.

MONOLITHIC ADOBE. Synonymous with *cob*.

NATURAL COB. Cob not containing admixtures such as Portland cement, lime, asphalt emulsion, or oil. Synonymous with *unstabilized cob*.

NONSTRUCTURAL WALL. Walls other than *load-bearing walls* or *shear walls*.

PLASTER. Clay, soil-cement, gypsum, lime, clay-lime, cement-lime, or cement plaster as described in Section AU104.

SHEAR WALL. A *cob* wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AU106.11. Synonymous with *braced wall panel*.

STABILIZED. Cob or other earthen material containing admixtures such as Portland cement, lime, asphalt emulsion, or oil, that are intended to help limit water absorption, stabilize volume, increase strength, and increase durability.

STRUCTURAL WALL. A wall that meets the definition for a *load-bearing wall* or *shear wall*.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

UNSTABILIZED. A Cob or other earthen material that does not contain admixtures such as Portland cement, lime, asphalt emulsion, or oil.

SECTION AU103 **MATERIALS, MIXING, AND INSTALLATION**

AU103.1 Clay subsoil. Clay subsoil for a *cob* mix shall be acceptable if the mix it produces meets the requirements of Section AU103.4.

AU103.2 Sand. Sand or other aggregates such as, but not limited to, gravel, pumice and lava rock, when added to *cob* mixes, shall yield a mix that meets the requirements of Section AU103.4.

AU103.3 Straw. Straw for *cob* mixes shall be from wheat, rice, rye, barley or oat, or similar reinforcing fibers with similar performance. Before mixing, the straw or other reinforcing fibers shall be dry to the touch and free of visible decay.

AU103.4 Mix proportions. Cob mixes shall be of any proportion of refined clay or clay subsoil, added sand (if any) and straw that produces a dried mix that passes the shrinkage test in accordance with Section AU103.4.1, complies with the compressive strength requirements of Section AU106.6 and complies with the modulus of rupture requirements of Section AU106.7.

AU103.4.1 Shrinkage test for cob mixes. Each proposed *cob* mix of different mix proportions shall be placed moist to completely fill a 24-inch by 3 1/2-inch by 3 1/2-inch (610 mm by 89 mm by 89 mm) wooden form on a plastic or paper slip sheet and dried to ambient moisture conditions, or oven dried. The total shrinkage of the length shall not exceed 1 inch (25 mm), as measured from the dried edges of the material to the insides of the form. Cracks in the sample > 1/16 inch (1.5 mm) shall first be closed manually. The shrinkage test shall be shown to the building official for approval before placement of the cob mix onto walls.

AU103.5 Mixing. The clay subsoil, sand and straw for *cob* shall be thoroughly mixed by manual or mechanical means with water sufficient to produce a mix of a plastic consistency capable of bonding of successively placed layers or *lifts*.

AU103.6 Installation. Cob shall be installed on the wall in *lifts* of a height that supports itself with minimal slumping.

AU103.7 Dry joints. Each layer of cob shall be prevented from drying until the next layer is installed, to ensure bonding of successive layers. The top of each layer shall be kept moist and malleable with one or more of the following methods:

1. Covering with a material that prevents loss of or holds moisture,
2. Covering with a material that shades it from direct sun, or
3. Wetting.

When dry joints are unavoidable, the previous layer shall be wetted prior to application of the next layer.

AU103.8 Drying holes. Where holes to facilitate drying are used, such holes shall be of any depth and not exceeding 3/4-inch (19 mm) in diameter on the face of *cob* walls. Drying holes shall not be spaced closer than ten hole-diameters. Drying holes shall not be placed in *braced wall panels*. The design load on load-bearing walls with drying holes shall not exceed 90% of the allowable bearing capacity as determined in accordance with Section AU106.8. Drying holes shall be filled with *cob* before final inspection.

AU103.9 Adding roof loads to walls. Roof and ceiling loads shall not be added until walls are sufficiently dry to support them without compressing.

SECTION AU104 **FINISHES**

AU104.1 General. *Cob* walls shall not require a *finish*, except as required by Section AU104.2. Finishes applied to *cob* walls shall be plasters in accordance with Section AU104.4, non-plaster exterior wall coverings in accordance with Section R703 or other finish systems in accordance with the following:

1. Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.
2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.
3. Finish systems with weights >10 and ≤ 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m²) of wall shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.
4. Finish systems with weights > 20 pounds per square foot (> 97.8 kg/m²) of wall area shall require an engineered design.

AU104.2 Where required. *Cob* walls exposed to rain due to local climate, building design and wall orientation shall be finished or clad to provide protection from excessive erosion.

AU104.3 Vapor retarders. Class I and II vapor retarders shall not be used on *cob* walls, except at *cob* walls surrounding showers or as required or addressed elsewhere in this appendix.

AU104.4 Plaster. *Plaster* applied to *cob* walls shall be any type described in this section. *Plaster* thickness shall not exceed 3 inches (76 mm) on each face except where an approved engineered design is provided.

AU104.4.1 Plaster and membranes. *Plaster* shall be applied directly to *cob* walls to facilitate transpiration of moisture from the walls and to secure a mechanical bond between the *plaster* and the *cob*. A membrane shall not be located between the *cob* wall and the *plaster*.

AU104.4.2 Plaster lath. The surface of *cob* walls shall be permitted to function as lath for plaster, with no other lath required. Metal, plastic, and natural fiber lath shall be permitted to be used to limit plaster cracking or increase the plaster bond to the wall, or to bridge dissimilar materials.

AU104.4.3 Clay plaster. *Clay plaster* shall comply with Sections AU104.4.3.1 and AU104.4.3.2.

AU104.4.3.1 General. *Clay plaster* shall be any plaster having a *clay* or *clay subsoil* binder. Such plaster shall contain sufficient clay to fully bind the sand or other aggregate and any reinforcing fibers. Reinforcing fibers shall be chopped straw, sisal, hemp, animal hair or other similar *approved* fibers.

AU104.4.3.2 Clay subsoil requirements. The suitability of *clay subsoil* shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

AU104.4.4 Soil-cement plaster. Soil-cement plaster shall be composed of *clay subsoil*, sand, not more than 7 percent Portland cement by volume and, where provided, reinforcing fibers.

AU104.4.5 Gypsum plaster. Gypsum plaster shall comply with Section R702.2.1 and shall be limited to interior use.

AU104.4.6 Lime plaster. Lime plaster is any plaster with a binder composed of calcium hydroxide including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.

AU104.4.7 Clay-lime plaster. Clay-lime plaster shall be composed of refined *clay* or *clay subsoil*, sand, lime and, where provided, reinforcing fibers.

AU104.4.8 Cement-lime plaster. Cement-lime plaster shall be plaster mix types CL, F or FL, as described in ASTM C926.

AU104.4.9 Cement plaster. Cement plaster shall have not less than 1 part lime to 4 parts cement and be not thicker than 1-1/2 inches (38 mm), to ensure minimum acceptable vapor permeability.

SECTION AU105 **COB WALLS—GENERAL**

AU105.1 General. *Cob walls* shall be designed and constructed in accordance with this section and Figure AU101.4 or an *approved* alternative design. In addition to the general requirements for *cob* walls in this section, *cob structural walls* shall comply with Section AU106.

AU105.2 Building limitations and requirements for cob wall construction. *Cob* walls shall be subject to the following limitations and requirements:

1. Number of stories: not more than one.
2. Building height: not more than 25 feet (7620 mm).
3. Seismic design categories: limited to use in Seismic Design Categories A, B and C, except where an *approved* engineered design is provided.
4. Wall height: in accordance with Table AU105.4, and with Table AU106.11(1) for *braced wall panels*.
5. Wall thickness, excluding finish, shall be not less than 10 inches, not greater than 24 inches at the top two-thirds, not limited at the bottom third and, for structural walls, shall comply with Section AU106.2(2). Wall taper is permitted in accordance with Section AU106.5(1).
6. Interior *cob* walls shall require an *approved* engineered design that accounts for the seismic load of the interior *cob* walls, except in Seismic Design Category A for walls with a height to thickness ratio \leq to 6.

AU105.3 Out-of-plane resistance methods and unrestrained wall height limits. *Cob* walls shall employ a method of out-of-plane load resistance in accordance with Table AU105.3, and comply with its associated height limits and requirements.

AU105.3.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AU105.3 shall be in accordance with the ultimate design wind speed and seismic design category requirements of Sections R301.2.1 and R301.2.2 respectively. An *approved* engineered design shall be required where the building is located in a Special Wind Region or a Wind Design Required location in accordance with Figure R301.2(5)B.

TABLE AU105.3 OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL HEIGHT LIMITS

WALL TYPE ^{a, g, h} and METHOD OF OUT-OF-PLANE LOAD RESISTANCE	FOR ULTIMATE DESIGN WIND SPEEDS (mph)	FOR SEISMIC DESIGN CATEGORIES	UNRESTRAINED COB WALL HEIGHT H ^{b, c}		TOP ANCHOR ^e SPACING (inches)	TENSION TIE ^f SPACING (inches)
			Absolute limit in feet	Limit based on wall thickness T ^d in feet		
Wall 1 ⁱ : no anchors, no steel wall reinforcing	≤ 110	A	$H \leq 8$	$H \leq 6T$	none	48
Wall 2: top anchors ⁱ , continuous vertical 6"x6"x6 gage steel mesh in center of wall embedded in foundation 12"	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24
Wall A ⁱ : top anchors, no vertical steel reinforcing	≤ 120	A, B	$H \leq 8$	$H \leq 6T$	12	48
Wall B ⁱ : top & bottom anchors, no vertical steel reinforcing	≤ 130	A, B	$H \leq 8$	$H \leq 6T$	12	48
Wall C: top and bottom anchors, continuous vertical threaded rod at 4' oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24
Wall D: continuous vertical threaded rod at 1' oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	NA	24
Wall E: top anchors, continuous vertical 6"x6"x6 gage steel mesh 2" from each face of wall embedded in foundation	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

N/A = Not Applicable

a. See Table AU106.11(1) for reinforcing and anchorage specifications for wall types A, B, C, D and E.

b. H = height of the cob portion of the wall only. See Figure AU101.4. The maximum H is the absolute limit or the limit based on wall thickness, whichever is more restrictive.

c. Bond beams or other horizontal restraints are capable of separating a wall into more than one unrestrained wall height with an *approved* engineered design.

d. T = Cob wall thickness (in feet) at its minimum, without plaster.

e. 5/8-inch threaded rod anchors at prescribed spacing with 12" embedment in cob, full embedment in concrete bond beams or full penetration in wood bond beam with a nut and washer.

f. Attach rafters to bond beam with 4-inch by 3-inch by 3-inch by 18 gage tension tie angles at prescribed spacing. See Figure R608.9(9). Where rafters are attached to tension ties shall, roof sheathing shall be edge nailed.

g. All walls shall be tested for compressive strength in accordance with Section AU106.6.

h. For curved walls with an arc length:radius ratio of 1.5:1 or greater, the H/T factor shall be increased by 1, and the absolute height limit by 1 foot.

i. Wall type requires a modulus of rupture test in accordance with Section AU106.7.

j. See wall type A in Table AU106.11(1) for top anchor requirements.

AU105.3.2 Bond beams for nonstructural walls. Nonstructural *cob* walls shall be provided with a bond beam at the top of the wall that complies with Section AU106.9, except for requirements relating to roof and/or ceiling loads or *braced wall panels*.

AU105.3.3 Lintels in nonstructural walls. Door, window, and other openings in nonstructural *cob* walls shall require a lintel in accordance with Section AU106.10, except for requirements relating to roof and/or ceiling loads or *braced wall panels*.

AU105.3.4 Reinforcing at wall openings. Reinforcing shall be installed at window, door, and similar wall openings and penetrations greater than 2 feet (610 mm) in width in accordance with this section. Surface voids deeper than 25 percent of the wall thickness shall be considered an opening.

AU105.3.4.1 Opening size limit. Openings shall not exceed 6 feet (1829 mm) in width, and the height of the *cob* wall below openings shall not exceed 6 feet (1829 mm) above the top of the foundation.

AU105.3.4.2 Horizontal reinforcing. 2-inch by 2-inch (51 mm by 51 mm) 14 gage galvanized steel mesh shall be embedded 4 inches (102 mm) in the *cob* above the rough opening and below the rough opening for windows, and shall extend 12 inches (305 mm) beyond the sides of the opening. Walls below rough window openings greater than 4 foot 6 inches (1372 mm) in height shall be provided with additional horizontal reinforcing at mid-height.

AU105.3.4.3 Vertical reinforcing. Full-height 5/8-inch (16 mm) threaded rod shall be installed 4 inches (102 mm) from each side of the opening, centered in the thickness of the *cob* wall. The threaded rods shall be embedded 7 inches (178 mm) in the foundation, and 4 inches (102 mm) in concrete bond beams or shall penetrate through wood bond beams and be secured with a nut and washer. The threaded rods shall be embedded in concrete lintels, or pass through a drilled hole in wood lintels.

AU105.3.5 Minimum length of *cob* walls. Sections of *cob* walls between openings shall be not less than 2 foot 6 inches (762 mm) in length. Wall sections less than 4 feet (1219 mm) and not less than 2 foot 6 inches (762 mm) in length shall contain vertical reinforcing in accordance with Section AU105.3.4.3

AU105.4 Moisture control. *Cob* walls shall be protected from moisture intrusion and damage in accordance with Sections AU105.4.1 through AU105.4.5.

AU105.4.1 Water-resistant barriers and vapor permeance. *Cob* walls shall be constructed without a membrane barrier between the *cob* wall and *plaster* to facilitate transpiration of water vapor from the wall, and to secure a mechanical bond between the *cob* and *plaster*, except as otherwise required elsewhere in this appendix. Where a water-resistant barrier is placed behind an exterior finish, it shall be considered part of the finish system and shall comply with Section AU104.1(2) for the combined vapor permeance rating.

AU105.4.2 Horizontal surfaces. *Cob* walls and other *cob* elements shall be provided with a water-resistant barrier at weather-exposed horizontal surfaces. The water-resistant barrier shall be of a material and installation that will prevent erosion and prevent water from entering the wall system. Horizontal surfaces, including exterior window sills, sills at exterior niches, and exterior buttresses, shall be sloped not less than 1 unit vertical in 12 units horizontal to drain away from *cob* walls or other *cob* elements.

AU105.4.3 Separation of *cob* and foundation. A liquid-applied or bituminous Class II *vapor retarder* shall be installed between *cob* and supporting concrete or masonry.

Exception: Where local climate, site conditions and foundation design limit ground moisture migration into the base of the *cob* wall, including but not limited to the use of a moisture barrier or capillary break between the supporting concrete or masonry and the earth.

AU105.4.4 Separation of *cob* and finished grade. *Cob* shall be not less than 8 inches (203 mm) above finished grade.

Exception: The minimum separation shall be 4 inches (102 mm) in Dry climate zones as defined in Table N1101.7.2(1) [R302.3(1)], and shall be 2 inches (51mm) on walls that are not weather-exposed.

AU105.4.5 Installation of windows and doors. Windows and doors shall be installed in accordance with the manufacturer's instructions to a wooden frame of not less than nominal 2x4 (51 mm by 102 mm) wood members anchored into the *cob* wall with 16d galvanized nails half-driven at a maximum 6-inch (152 mm) spacing, with the protruding half embedded in the *cob*. The wood frame shall be embedded not less than 1-1/2 inches (38 mm) in the *cob* and shall be set in from each face of the wall not less than 3 inches (76 mm). Alternative window and door installation methods shall be capable of resisting the wind loads in Table R301.2(2). Windows and doors in *cob* walls shall be installed so as to mitigate the passage of air or moisture into or through the wall system. Window sills shall comply with Section AU105.4.2.

AU105.5 Inspections. The *building official* shall inspect the following aspects of *cob* construction in addition to the required tests of, and accordance with Section R109.1:

1. Anchors and vertical and horizontal reinforcing in cob walls, where required in accordance with Tables AU105.2 and AU106.11(1) and Sections AU105.3.4 and AU105.3.5.
2. Reinforcing in any concrete bond beams or lintels, in accordance with Sections AU106.9.2 and Table AU106.10.

SECTION AU106

COB WALLS—STRUCTURAL

AU106.1 General. Cob structural walls shall be in accordance with the prescriptive provisions of this section. Designs or portions of designs not complying with this section shall require an approved engineered design.

AU106.2 Requirements for cob structural walls. In addition to the requirements of Section AU105.2, cob structural walls shall be subject to the following:

1. Wall height: shall be in accordance with Table AU105.3 for load-bearing cob walls or AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
2. Wall thickness: shall be in accordance with Section AU105.2(5) and Section AU106.8.1 for load-bearing cob walls or AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
3. Braced wall panel lengths: for buildings using cob braced wall panels, the greater of the values determined in accordance with Tables AU106.11(2) for wind loads and AU106.11(3) for seismic loads shall be used.

AU106.3 Loads and other limitations. Live and dead loads and other limitations shall be in accordance with Section R301, except that the dead load for cob walls shall be determined with the following equation:

$$CW_{DL} = (H \times T_{avg} \times D) \text{ (Equation AU-1)}$$

where:

CW_{DL} = Cob wall dead load (in pounds per lineal foot of wall)

H = Height of cob portion of wall (in feet)

T_{avg} = Average thickness of wall (in feet)

D = Density of cob = 110 (in pcf), unless a lesser value at equilibrium moisture content is demonstrated to the building official

AU106.4 Foundations. Foundations for cob walls shall be in accordance with Chapter 4. The width of foundations for cob walls shall be not less than the width of the cob at its base, excluding finish.

AU106.5 Wall taper, straightness and surface voids for cob walls. Cob walls shall be in accordance with the following:

1. Cob structural and nonstructural walls shall be vertical, or shall taper from bottom to top with the wall thickness in accordance with Section AU105.2(5) and the wall height in accordance with AU105.2(4).
2. Cob structural and nonstructural walls shall be straight or curved. Curved braced wall panels shall be in accordance with Sections AU106.11.2 and AU106.11.3.
3. Niches and other surface voids in load-bearing walls are limited to 12 inches (305 mm) in width and height and 25 percent of the wall thickness, and shall be located in the top two-thirds of the wall. Surface voids that exceed these limits shall be considered wall openings, and shall receive a lintel in accordance with Section AU106.10 and be reinforced in accordance with Section AU105.3.4. Surface voids are prohibited in braced wall panels.

AU106.6 Compressive strength of cob structural and nonstructural walls. All cob walls shall have a minimum compressive strength of 60 psi (414 kPa). Cob in walls used as braced wall panels shall have a minimum compressive strength of 85 psi (586 kPa).

AU106.6.1 Demonstration of compressive strength. The compressive strength of the cob mix to be used in structural walls and nonstructural walls as required in Section AU106.6 shall be demonstrated to the building official before the placement of cob onto walls, with compressive strength tests and an associated report by an approved laboratory or with an approved on-site test as follows:

1. Five samples of the proposed cob mix shall be placed moist to completely fill a 4-inch by 4-inch by 4-inch (102 mm by 102 mm by 102 mm) form and dried to ambient moisture conditions. Samples shall not be oven dried. Any opposite faces shall be faced with plaster of Paris if needed to achieve smooth, parallel faces, after which the sample shall reach ambient moisture conditions before testing. The horizontal cross-section of the dried sample as tested, and the maximum applied load at failure shall be used to calculate the sample's compressive strength. The fourth lowest value shall be used to determine the mix's compressive strength.

AU106.7 Modulus of rupture of cob structural walls. Cob in walls used as braced wall panels shall have a minimum modulus of rupture of 50 psi (345 kPa).

AU106.7.1 Demonstration of modulus of rupture. The modulus of rupture of cob used in structural walls as required in Section AU106.7 shall be demonstrated to the building official before the placement of cob onto walls, with modulus of rupture tests and an associated report by an approved laboratory or with an approved on-site test as follows:

1. Five samples of the proposed *cob* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm by 152 mm by 305 mm) form and dried to indoor ambient moisture conditions. Samples shall not be oven dried. Each sample shall be tested with the 12-inch (305 mm) dimension horizontal. The fourth lowest value shall be used to determine if the mix's meets the minimum required modulus of rupture.

AU106.8 Bearing capacity. The allowable bearing capacity for *cob load-bearing walls* supporting vertical roof and/or ceiling loads imposed in accordance with Section R301 shall be determined with the following equation:

$$BC = (C \times T_{min})/3 - (H \times T_{avg} \times D) \text{ (Equation AU-2)}$$

where:

BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall)

C = Compressive strength (in psi) as determined in accordance with Section AU106.6

T_{min} = Thickness of wall (in feet) at its minimum

H = Height of *cob* portion of wall (in feet)

T_{avg} = Average thickness of wall (in feet)

D = Density of *cob* = 110 (in pcf), unless a lesser value at equilibrium moisture content is demonstrated

AU106.8.1 Support of uniform loads. Uniform roof and/or ceiling loads shall be supported by *cob load-bearing walls* not exceeding their allowable bearing capacity, as demonstrated in accordance with the following equation:

$$BL \leq BC \text{ (Equation AU-3)}$$

where:

BL = Design load on the wall (in pounds per lineal foot) determined in accordance with Sections R301.4 and R301.6

BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall) determined in accordance with Section AU106.8

AU106.8.2 Support of concentrated loads. Concentrated roof and/or ceiling loads shall be distributed by structural elements capable of distributing the loads to the *cob load-bearing wall* and within its allowable bearing capacity as determined in accordance with Section AU106.8. Concentrated loads over lintels or over bond beams spanning openings shall require an *approved* engineered design.

AU106.9 Bond beams. *Cob structural walls* shall require a bond beam at the top of the wall in accordance with Sections AU106.9.1, AU106.9.2 or AU106.9.3, and shall be anchored to the *cob* below in accordance with Tables AU105.3, AU106.11(1) and AU106.12 as applicable and most restrictive. Bond beams spanning openings shall be in accordance with Section AU106.9.4.

AU106.9.1 Wood bond beams. Wood bond beams shall be not less than nominal 4 inches high by 8 inches wide and shall comply with Sections AU106.9.1.1 through AU106.9.1.3.

AU106.9.1.1 Wood species and grade. Wood bond beams shall be of a species with an extreme fiber in bending (F_b) of not less than 850 psi (5.9 MPa), a modulus of elasticity (E) of not less than 1,300,000 psi (8964 MPa), and of No. 2 grade or better. Composite lumber bond beams shall have an extreme fiber in bending (F_b) of not less than 850 psi (5.9 MPa), and a modulus of elasticity (E) of not less than 1,300,000 psi (8964 MPa).

AU106.9.1.2 Discontinuity. Discontinuous wood bond beams shall be spliced on top with a metal strap with not less than the allowable wind or seismic load tension capacity in accordance with the following, whichever is more restrictive:

1. For seismic design categories: A: 2500 pounds (11 kN). B: 4500 pounds (20 kN). C: 6000 pounds (26.7 kN).
2. For braced wall line lengths, when wind governs: 10 feet: 2500 pounds (11 kN). 20 feet: 3400 pounds (15.1 kN). 30 feet: 5000 pounds (22.2 kN).

AU106.9.1.3 Corners and curved walls. Wood bond beams at corners and discontinuities atop curved walls shall be connected across their exterior faces with a metal strap with a capacity of not less than that determined in in accordance Section AU106.9.2.

AU106.9.2 Concrete bond beams. Concrete bond beams shall be not less than 6 inches (152 mm) high by 8 inches (305 mm) wide. Concrete bond beams shall be reinforced with two # 4 bars, 2 inches (51 mm) clear from the bottom and 2 inches (51 mm) clear from the sides. Lap splices shall comply with Table R608.5.4(1). Reinforcing at corners shall be in accordance with the horizontal reinforcing requirements in Section R608.6.4. The concrete shall have a compressive strength of not less than 2500 psi (17.2 MPa) at 28 days.

AU106.9.3 Other bond beams. Bond beams of other materials, including earthen materials, require an *approved* engineered design.

AU106.9.4 Bond beams spanning openings. Bond beams that support uniform roof and/or ceiling loads and span openings in *cob* walls shall be

in accordance with Table AU106.10. Bond beams shall be continuous across the opening and not less than 1 foot (305 mm) beyond each side of the opening.

AU106.9.5 Connection of roof framing to bond beams. Roof and ceiling framing shall be attached to bond beams in accordance with Table R602.3(1), Items 2, 6, 30, 31, and 32. Tension ties shall be provided in accordance with Figure R608.9(9) and Footnote f of Table AU105.3. 10d toe nails at 6 inches (152 mm) on center shall be provided from the rim blocking to top plate for the entirety of braced wall lines, instead of the 43 mil strap shown in Figure R608.9(9). A nominal 2-inch by 6-inch (51 mm by 152 mm) wood plate shall be installed on concrete bond beams with 5/8-inch (16 mm) diameter anchor bolts with 5-inch (127 mm) embedment at 2 feet (610 mm) on center to allow the required fastening of roof and ceiling framing, including tension ties and toe nailing of rim blocking.

AU106.9.6 Bond beams at gable and shed roof end walls. Bond beams at end walls of buildings with gable or shed roofs shall comply with the following:

1. End walls shall not exceed 20 feet (6096 mm) in length.
2. Shall be continuous and straight for the entire wall line.
3. Wood bond beams when used shall comply with the following:
 - 3.1. Not less than nominal 4x8 (102 mm by 203 mm) when wind design governs in accordance with Tables AU106.11(2) and AU106.11(3), and for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category A, and for wall lengths ≤ 10 feet (3048 mm) in Seismic Design Categories B and C.
 - 3.2. Not less than nominal 4x10 (102 mm by 254 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category B.
 - 3.3. Not less than nominal 6x12 (152 mm by 305 mm) or 4x16 (102 mm by 406 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category C.
4. Concrete bond beams when used shall be in accordance with Section AU106.9.2 in Seismic Design Categories A, B, and C and for ultimate design wind speeds ≤ 140 mph (63.6 m/s).
5. Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602.

AU106.10 Lintels. Door, window, and other openings in load-bearing cob walls shall be provided with a lintel of wood or concrete in accordance with Table AU106.10.

TABLE AU106.10 LINTELS AND BOND BEAMS SPANNING OPENINGS

• GROUND SNOW LOAD ≤ 30 PSF			WOOD:		CONCRETE:	
			$F_p \geq 850$ PSI		2500 PSI COMPRESSIVE STRENGTH	
			$E \geq 1,300,000$ PSI		HEIGHT = 6"	
			NO. 2 GRADE OR BETTER		EXTEND 1 FT BEYOND OPENING SIDES	
			ORIENTED FLAT		REINFORCEMENT: 2 - #4 BARS^a	
			1 PIECE OR 2 EQUAL-WIDTH PIECES		2" CLEAR FROM BOTTOM	
			EXTEND 1 FT BEYOND OPENING SIDES		2" CLEAR FROM SIDES^a	
Building width (feet)	Cob above lintel (feet)	Total cob wall and plaster thickness (inches)	SIZE OF WOOD LINTEL OR BOND BEAM		WIDTH OF CONCRETE LINTEL OR BOND BEAM	
			H x W (nominal inches)		(inches)	
			For Span ≤ 4'	For Span ≤ 6'	For Span ≤ 6'	For Span ≤ 8'
10	0	≤ 27	4x8	4x8	8	8
10	1	15	4x12	4x12	12	12
10	1	19	4x16	4x16	16	16
10	1	27	4x24	4x24	24	24
10	2	15	4x12	6x12	12	12
10	2	19	4x16	6x16	16	16
10	2	27	4x24	4x24	24	24
20	0	≤ 27	4x8	6x8	8	8
20	1	15	4x12	6x12	12	12

<u>20</u>	<u>1</u>	<u>19</u>	<u>4x16</u>	<u>6x16</u>	<u>16</u>	<u>16</u>
<u>20</u>	<u>1</u>	<u>27</u>	<u>4x24</u>	<u>4x24</u>	<u>24</u>	<u>24</u>
<u>20</u>	<u>2</u>	<u>15</u>	<u>4x12</u>	<u>6x12</u>	<u>12</u>	<u>NP</u>
<u>20</u>	<u>2</u>	<u>19</u>	<u>4x16</u>	<u>6x16</u>	<u>16</u>	<u>NP</u>
<u>20</u>	<u>2</u>	<u>27</u>	<u>4x24</u>	<u>6x24</u>	<u>24</u>	<u>NP</u>
<u>30</u>	<u>0</u>	<u>≤ 27</u>	<u>4x8</u>	<u>6x8</u>	<u>8</u>	<u>NP</u>
<u>30</u>	<u>1</u>	<u>15</u>	<u>4x12</u>	<u>6x12</u>	<u>12</u>	<u>NP</u>
<u>30</u>	<u>1</u>	<u>19</u>	<u>4x16</u>	<u>6x16</u>	<u>16</u>	<u>NP</u>
<u>30</u>	<u>1</u>	<u>27</u>	<u>4x24</u>	<u>6x24</u>	<u>24</u>	<u>NP</u>
<u>30</u>	<u>2</u>	<u>15</u>	<u>4x12</u>	<u>6x12</u>	<u>12</u>	<u>NP</u>
<u>30</u>	<u>2</u>	<u>19</u>	<u>4x16</u>	<u>6x16</u>	<u>16</u>	<u>NP</u>
<u>30</u>	<u>2</u>	<u>27</u>	<u>4x24</u>	<u>6x24</u>	<u>24</u>	<u>NP</u>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

NP = Not Permitted

a. Concrete bond beams spanning openings, and lintels greater than 16 inches in width, shall have an additional #4 bar in the center of their width.

AU106.11 Cob braced wall panels. *Cob braced wall panels* shall be in accordance with Section R602.10 and Tables AU106.11(1), AU106.11(2) and AU106.11(3A), AU106.11(3B) and AU106.11(3C). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An *approved* engineered design shall be required in accordance with Section R301.2.1 where the building is located in a Special Wind Region or a Wind Design Required location in accordance with Figure R301.2(5)B.

AU106.11.1 Non-orthogonal braced wall panels. *Braced wall panels* at an angle to the orthogonal braced wall lines shall be considered to contribute to the minimum total braced wall lengths in Tables AU106.11(2) and AU106.11(3) as follows:

1. A braced wall panel not more than 45 degrees and greater than 30 degrees to an adjacent orthogonal braced wall line shall contribute 50% of its length to that line.
2. A braced wall panel not more than 30 degrees to an orthogonal braced wall line shall contribute 65 percent of its length to that line.
3. A braced wall panel greater than 45 degrees and not more than 60 degrees to an orthogonal braced wall line shall contribute 35 percent of its length to that line.
4. The angle of a curved braced wall panel to a braced wall line shall be determined with the chord of that section of wall, connecting the end points of the arc at the center of the wall.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved *cob* walls shall contain two braced wall lines in two orthogonal directions. The spacing of the braced wall lines for wind design in Table AU106.11(2) and the spacing and length of the braced wall lines for seismic design in Table AU106.11(3), shall be the maximum widths of the building in the two orthogonal directions.

AU106.11.3 Radius, thickness and length of curved braced wall panels. *Cob curved braced wall panels* shall have an inside radius of not less than 5 feet (1524 mm), shall be of the thickness required in Table AU106.11(1) and of the length determined in accordance with Section AU106.11. The curved wall's length shall be considered to be the length of the arc at the center of the wall, in accordance with Figure AU106.11.3 and determined with the following equation:

$$ARC_C = .0175 R_C \times A \text{ (Equation AU-4)}$$

where:

ARC_C = Length of arc at center of wall (in feet)

R_C = Radius at center of wall = $R_I \pm .5T$ (in feet)

R_I = Inside radius of wall (in feet)

T = Thickness of wall without finish (in feet)

A = Angle of extent of braced wall panel from the center of the arc (in degrees)

FIGURE AU106.11.3 CURVED BRACED WALL PANEL

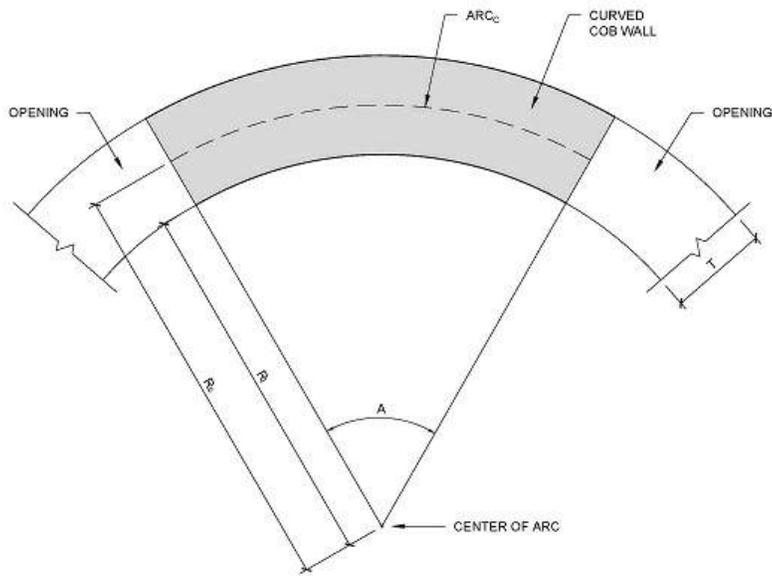


TABLE AU106.11(1) COB BRACED WALL PANEL TYPES

WALL TYPE^a DESIGNATION	ANCHORS TO FOUNDATION^b	ANCHORS TO BOND BEAM^c	VERTICAL STEEL REINFORCING^{b,c}	HORIZONTAL STEEL REINFORCING	MAXIMUM HEIGHT H^d (in feet)	MAXIMUM ASPECT RATIO (H:L)
A	none	5/8" threaded rod @12" 4" from wall ends 12" embedment in cob	none	none	7 ^e	1:1
B	#5 bar @ 12" 16" embedment in cob	5/8" threaded rod @12" 4" from wall ends 16" embedment in cob 2"x2"x1/4" washer and nut at cob end	none	2"x2"x14 gage welded wire mesh ^f @ 18", 6" from foundation and bond beam	7 ^e	1:1
C	#5 bar @ 12" 16" embedment in cob	5/8" threaded rod @12" 16" embedment in cob	5/8" threaded rod 4" from each end of braced wall panel continuous from foundation to bond beam	2"x2"x14 gage welded wire mesh ^f @ 18", 6" from foundation and bond beam	7 ^e	2:1
D	(see vertical steel reinforcing)	(see vertical steel reinforcing)	5/8" threaded rod 4" from each end of braced wall panel and @12", continuous from foundation to bond beam	2"x2"x14 gage welded wire mesh ^f @ 18", 6" from foundation and bond beam	7 ^e	2:1

E	6"x6"x6 gage welded wire mesh 12" embedment in foundation	5/8" threaded rod @12" 4" from wall ends 12" embedment in cob	6"x6"x6 gage welded wire mesh 2" from each wall face	none	7.5	1:1
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SI: 1 inch = 25.4 mm.

a. *Braced wall panel* types A, B, C, and D shall be not less than 16 inches thick. *Brace wall panel* type E shall be not less than 12 inches thick. All *braced wall panels* shall be not greater than 24 inches thick.

b. Not less than 8" embedment into foundation, unless otherwise stated.

c. Not less than 4" embedment into concrete bond beams. Full penetration through wood bond beam, secured with nut and washer.

d. *H* = height of the cob portion of the wall only. See Figure AU101.4.

e. Maximum height shall be 8 feet when wall thickness is increased to 18".

f. Galvanized mesh.

TABLE AU106.11(2) BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON WIND SPEED

EXPOSURE CATEGORY B^d		MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d}				
25-FOOT MEAN ROOF HEIGHT						
10-FOOT EAVE-TO-RIDGE HEIGHT^d						
10-FOOT WALL HEIGHT^d						
2 BRACED WALL LINES^d						
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Cob braced wall panel^e A (aspect ratio H:L ≤ 1:1)	Cob braced wall panel^e B (aspect ratio H:L ≤ 1:1)	Cob braced wall panel^e C, D (aspect ratio H:L ≤ 2:1)	Cob braced wall panel^e E (aspect ratio H:L ≤ 1:1)
10	6.0	6.0	3.7	NP	-	-
≤ 110	One-story building	20	7.9	7.4	7.4	NP
30	11.8	11.0	11.0	NP	-	-
10	6.0	6.0	4.1	NP	-	-
≤ 115	One-story building	20	8.7	8.1	8.1	NP
30	13.0	12.1	12.1	NP	-	-
10	6.0	6.0	4.4	NP	-	-
≤ 120	One-story building	20	9.4	8.8	8.8	NP
30	14.1	13.1	13.1	-	-	-
10	6.0	6.0	5.1	NP	-	-
≤ 130	One-story building	20	11.0	10.3	10.3	NP

30	16.5	15.4	15.4	NP	-	-
10	6.0	6.0	5.9	NP	-	-
≤ 140	One-story building	20	12.7	11.9	11.9	NP
30	19.1	17.8	17.8	NP	-	-

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

- a. Linear interpolation shall be permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.
- d. Subject to applicable wind adjustment factors associated with Items 1 and 2 of Table R602.10.3(2).
- e. Cob braced panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

TABLE AU106.11(3A) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY A

<ul style="list-style-type: none"> • SOIL CLASS D^e • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY A • 1.5" PLASTER THICKNESS EACH SIDE^h 				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d}		
Braced wall line spacing (feet)	Braced wall line length (feet)	Braced wall line % openings	Perpendicular braced wall line % openings	Cob-braced wall panel ^e A, B	Cob-braced wall panel ^e C, D	Cob-braced wall panel ^e E
10	30	Any % ^a	Any % ^a	Wind ⁱ	Wind ⁱ	NP
20	20	Any % ^a	Any % ^a	Wind ⁱ	Wind ⁱ	NP
20	30	Any % ^a	Any % ^a	Wind ⁱ	4.5	NP
30	30	Any % ^a	Any % ^a	Wind ⁱ	Wind ⁱ	NP

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.
- d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).
- e. Cob braced panel types indicated shall comply with Sections AU106.11.1 and AU106.11.2 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.

g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).

h. For total plaster thickness between 3-inches and 6-inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).

AU106.11(3B) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY B

<ul style="list-style-type: none"> • SOIL CLASS D^e • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY B • 1.5" PLASTER THICKNESS EACH SIDE^h 				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d}		
Braced wall line spacing (feet)	Braced wall line length (feet)	Braced wall line % openings	Perpendicular braced wall lines % openings	Cob-braced wall panel^e A, B	Cob-braced wall panel^e C, D	Cob-braced wall panel^e E
10	10	Any % ^a	Any % ^a	Wind ⁱ	Wind ⁱ	NP
10	20	0	Any % ^a	6.0	4.9	NP
10	20	50	Any % ^a	6.0	Wind ⁱ	NP
10	30	0	Any % ^a	7.1	6.6	NP
10	30	50	Any % ^a	6.0	4.5	NP
20	10	0	0	6.0 ⁱ	4.9 ⁱ	NP
20	10	0	50	6.0	Wind ⁱ	NP
20	10	50	Any % ^a	6.0	4.2	NP
20	10	50	50	6.0	4.2	NP
20	20	0	0	7.4	6.9	NP
20	20	0	50	6.0	5.5	NP
20	20	50	0	6.0	5.5	NP
20	20	50	50	6.0	4.1	NP
20	30	0	0	9.4	8.8	NP
20	30	0	50	7.9	7.4	NP
20	30	50	0	7.2	6.7	NP
20	30	50	50	6.0	5.3	NP
30	10	Any % ^a	Any % ^a	Wind ⁱ	Wind ⁱ	NP
30	20	0	0	9.4	8.8	NP
30	20	0	50	Wind ⁱ	Wind ⁱ	NP
30	20	50	Any % ^a	7.9	Wind	NP
30	30	0	0	11.8	11.0	NP
30	30	0	50	9.5	8.9	NP
30	30	50	0	9.5	8.9	NP
30	30	50	50	Wind ⁱ	Wind ⁱ	NP

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4)

e. Cob braced panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.

g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).

h. For total plaster thicknesses 3-inches to 6-inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).

j. Total plaster thicknesses shall be not greater than 3-inches. Substitute 15/32" roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU106.11(3C) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY C

<ul style="list-style-type: none"> • <u>SOIL CLASS D^e</u> • <u>TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM)</u> • <u>COB WALL HEIGHT PER TABLE AS106.11(1)</u> • <u>15 PSF ROOF-CEILING DEAD LOAD^d</u> • <u>STORY LOCATION: ONE-STORY BUILDING</u> • <u>SEISMIC DESIGN CATEGORY C</u> • <u>1.5" PLASTER THICKNESS EACH SIDE^h</u> 				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d}		
<u>Braced wall line spacing (feet)</u>	<u>Braced wall line length (feet)</u>	<u>Braced wall line % openings</u>	<u>Perpendicular braced wall lines % openings</u>	<u>Cob-braced wall panel^e A, B</u>	<u>Cob-braced wall panel^e C, D</u>	<u>Cob-braced wall panel^e E</u>
10	10	0	0	8.3 ⁱ	7.8 ⁱ	NP
10	10	0	50	6.5	6.1	NP
10	10	25	0	7.4 ⁱ	6.9 ⁱ	NP
10	10	50	50	4.7	4.4	NP
10	15	0	0	10.6	9.9	NP
10	15	0	50	8.7	8.2	NP
10	15	50	0	7.8	7.3	NP
10	15	50	50	6.0	5.6	NP
10	20	0	0	12.8	11.9	NP
10	20	0	50	11.0	10.2	NP
10	20	50	0	9.1	8.5	NP
10	20	50	50	7.3	6.8	NP
15	10	25	0	9.6	9.0	NP
15	10	0	50	7.8	7.3	NP
15	10	50	0	8.7	8.2	NP
15	10	50	50	6.0	5.6	NP
15	15	0	0	12.9	12.1	NP

15	15	0	50	10.2	9.5	NP
15	15	50	0	10.2	9.5	NP
15	15	50	50	7.5	7.0	NP
15	20	0	0	15.3	14.3	NP
15	20	0	50	12.6	11.7	NP
15	20	50	0	11.7	10.9	NP
15	20	50	50	8.9	8.3	NP
20	10	25	0	NP	NP	NP
20	10	0	50	9.1	8.5	NP
20	10	50	Any % ^a	NP	NP	NP
20	10	50	50	7.3	6.8	NP
20	15	0	0	NP	NP	NP
20	15	0	50	11.7 ⁱ	10.9 ⁱ	NP
20	15	50	0	NP	NP	NP
20	15	50	50	8.9 ⁱ	8.3 ⁱ	NP
20	20	0	0	NP	NP	NP
20	20	0	50	14.2	13.3	NP
20	20	50	0	NP	NP	NP
20	20	50	50	NP	9.9	NP

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between *S_ds* values associated with the seismic design categories is allowable where a site-specific *S_ds* value is determined in accordance with Section 1613.3 of the *International Building Code*.

g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).

h. For total plaster thicknesses 3" to 6", multiply the minimum total length of braced wall panels by 1.2.

i. Total plaster thickness > 3" is not permitted. Substitute 15/32" roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU106.12 Resistance to wind uplift forces. Cob walls that resist uplift forces from the roof assembly, as determined in accordance with Section R802.11, shall be in accordance with Table AU106.12.

TABLE AU106.12 ANCHORAGE OF BOND BEAMS FOR WIND UPLIFT

· ANCHORS: 5/8" ALL THREAD AT 12" O.C. ^{a,b}
· 2"x2"x1/4" WASHERS AND NUT AT END IN COB
· 4" EMBEDMENT IN CONCRETE BOND BEAMS
· FULL PENETRATION THROUGH WOOD BOND BEAMS WITH 2"x2"x1/4" WASHER AND NUT
ANCHORAGE DEPTH IN INCHES, PER WALL WIDTH AND WIND UPLIFT FORCE

WIND UPLIFT FORCE FROM TABLE R802.11 (PLF)	≤ 12" wall width^c	≤ 16" wall width^c	≤ 24" wall width^c
< 75	16	12	12
< 100	24	16	12
< 150	4' o.c. continuous from foundation to bond beam ^d	24	16
< 200	4' o.c. continuous from foundation to bond beam ^d	4' o.c. continuous from foundation to bond beam ^d	24

a. For wood bond beams a maximum of 6" from bond beam ends.

b. For min. 6"x8" concrete bond beams, at 18" o.c. for wind uplift forces < 75 plf., and at 16" o.c. for wind uplift forces < 100 plf.

c. Excluding finishes.

d. With 7-inch embedment in foundation, 4-inch embedment in concrete bond beam or full penetration through wood bond beam with 2"x2"x1/4" washer and nut.

AU106.13 Post-and-beam with cob infill. Post-and-beam with *cob* infill wall systems shall be in accordance with an *approved* engineered design.

AU106.14 Buttresses. *Cob* buttresses that are intended to provide out-of-plane wall bracing, or additional capacity for *braced wall panels* shall be in accordance with an *approved* engineered design.

SECTION AU107 **COB FLOORS**

AU107.1 Cob floors. *Cob* floors supported by grade shall be in accordance with an *approved* specification. Straw shall not be required in the material mix.

SECTION AU108 **FIRE RESISTANCE**

AU108.1 Fire-resistance rating. *Cob* walls shall be considered to exhibit a 1-hour fire-resistance rating in accordance with the following:

1. Wall thickness shall be 10 inches (254 mm) or greater.
2. Density shall be 70 pcf (1121 kg/m³) or greater.
3. When used as a load-bearing wall, the maximum design load shall be 1000 pounds per lineal foot (14,590 N/m) in accordance with Section AS106.8.
4. When used as a braced wall panel, the wall shall be in accordance with Section AS106.11.

AU108.2 Clearance to fireplaces and chimneys. *Cob* walls or other *cob* surfaces shall not require clearance to fireplaces and chimneys, except where clearance to non-combustibles is required by the manufacturer's instructions.

SECTION AU109 **THERMAL PERFORMANCE**

AU109.1 Thermal characteristics. *Cob walls* shall be classified as mass walls in accordance with Section N1102.2.5 (R402.2.5) and shall meet the R-value requirements for mass walls in Table N1102.1.2 (R402.1.2).

AU109.2 Thermal resistance. The unit R-value for *cob* walls with a density of 110 pcf (1762 kg/m³) shall be R-0.22 per inch of *cob* thickness. Walls that vary in thickness along their height or length shall use the average thickness of the wall to determine its R-value. The thermal resistance values of air films and finish materials or additional insulation shall be added to the *cob* wall's thermal resistance value to determine the R-value of the wall assembly.

AU109.3 Additional insulation. When insulating materials are added to the face of a *cob* wall, the combination of additional insulation and any associated connecting, weather-resisting, or protective materials shall comply with Section AU104.1, Items 1-4.

SECTION AU110 REFERENCED STANDARDS ASTM C5—10 Standard Specification for Quicklime for Structural Purposes - AU104.4.6.1

ASTM C141/C141M—14 Standard Specification for Hydrated Hydraulic Lime for Structural Purposes - AU104.4.6.1

ASTM C206—14 Standard Specification for Finishing Hydrated Lime - AU104.4.6.1

ASTM C1707—11 Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes - AU104.4.6.1

Reason: Cob is an earthen material mix of clay-soil, sand, straw, and water, placed onto a wall in layers to create a monolithic wall. Because the material mix and density of cob are very similar to those of adobe bricks, cob is sometimes known as “monolithic adobe.”

Cob has been used for thousands of years around the world, notably in England and Northern Europe, the Middle East, West Africa, China, and the Southwestern United States. An estimated 20,000 cob homes are still inhabited in the English county of Devon alone, some dating from the 15th century. The term “cob” derives from an Old English word for “lump,” since historical structures were often constructed one handful at a time.



2-Story Cob Cottage in Devon, England, Built in the 1400s



2-Story Cob House Built In 1860, Aniseed Valley, New Zealand

Today, cob is often mixed mechanically using a tractor or mortar mixer, but the wall construction is still generally manual. Cob buildings typically feature raised impermeable foundations and extended roof eaves to protect the walls from moisture and weather. Walls are often plastered with clay, lime or gypsum plasters which protect and beautify the cob without leading to the moisture problems associated with less vapor-permeable finishes such as cement stucco on historic adobe structures.

Since the 1990's, there has been increasing interest in cob construction in the United States and much of the world. Like other earthen construction methods, cob can greatly reduce embodied energy and life-cycle CO₂ emissions of buildings. Cob is highly recyclable, and with good design, construction and maintenance, can withstand centuries of use. The constituent materials are inexpensive compared with lumber, steel, concrete and other commonly used building materials. Cob is non-combustible and non-toxic in all stages of construction and use. Cob's thermal mass and moisture management properties modulate interior temperature and humidity, creating healthful building.



Modern Cob House, Devon England

While adobe is included in the masonry chapter of the IBC, and cob building codes or guidelines exist in England and New Zealand, there is currently no cob building code in the United States. As a result, permitting of cob buildings has been left to individual building officials on a case-by-case basis. Designers, builders and officials may be unaware of proper practices to make cob buildings safe and durable. Nevertheless, the desire to utilize cob construction continues, and promises to accelerate in response to economic and environmental pressures. These include the need for non-combustible construction systems that can withstand the increased frequency and intensity of wildfires in the western U.S. The lack of a cob building code has been an impediment to the proper and broader use of cob construction.



First Permitted Cob Structure, Berkeley, California

The proposed Cob Construction appendix for the IRC was created in response to this need. It is based on New Zealand's earthen building standards, on US codes for the closely-related earthen building systems of adobe and straw-clay, and on the experience and the testing of cob buildings over the past 25 years by architects, engineers, builders, and academics throughout the U.S. and the world. It has received review and input from over 25 experts including 4 architects and 6 civil engineers, including the architect and chair of the Committee that developed the New Zealand Standard for Earth Buildings. Much of the recent testing and research has been compiled or performed by the California-based Cob Research Institute, a non-profit organization founded in 2008 to remove legal barriers to cob construction and promote its safe use. If adopted, the proposed appendix will serve designers, builders, owners, inhabitants, and building officials alike in the design and construction of safe and durable cob buildings.

Supporting documents for the proposed Cob Construction appendix is available at: <https://www.cobcode.org/cobcode-documents>

Rationale for Specific Sections of Proposed Appendix U – Cob Construction

GENERAL:

Cob construction can help address the increasing need to reduce our buildings' negative impacts on the environment, including the global climate, and address the impacts of a changing climate on buildings, including increased firestorms. Like other earthen wall systems, cob is among the most fire-resistant building materials available, while also having a low environmental impact. The ability to build with site- or locally-sourced materials further reduces processing and transportation impacts as well as costs.

Though cob construction is not an industrialized building system, its centuries of continuous use in many parts of the world provide empirical evidence and guidance for good practice. This appendix gives the building official greater flexibility to consider empirical evidence and lifecycle impacts in meeting the intent of the code while not abridging health and life-safety requirements.

DEFINITIONS:

Cob-specific terms not found in the IRC are defined. Some terms already defined in the IRC are adjusted to give specific meaning for cob construction. Some definitions are consistent with identical terms defined in IRC Appendix R – Light Straw Clay Construction, and Appendix S – Strawbale Construction.

MATERIALS, MIXING AND INSTALLATION:

The provisions for materials, mixing, and installation are based on existing codes, standards, and guidelines from the UK, New Zealand and the U.S., including ASTM E2392-10 Standard Guide for the Design of Earthen Wall Systems, as well as the experience of designers and builders of cob and earthen buildings in the U.S. and other countries.

Though the materials for cob can vary considerably, the material specifications coupled with the mix design tests for shrinkage, compressive strength and modulus of rupture ensure adequate strength and stability of the wall materials.

FINISHES:

Where cob walls are not substantially rain-exposed they are allowed to remain without finish. Minor erosion has proven to be acceptable on cob walls, and is a matter of maintenance, not unlike the need to periodically repaint the exterior of buildings of conventional construction. However, where cob walls are susceptible to excessive erosion or water intrusion from weather, finishes are necessary to protect the wall while ensuring that any moisture that might enter the wall is able to escape without causing harm. Thus, finishes and finish assemblies must be a minimum of 5 perms, the IRC defined threshold of vapor permeable. Class I and II vapor retarders are prohibited on cob walls except where specifically permitted or required, for example at showers.

A range of plaster types are allowed and described, specifying critical components and characteristics of the plasters, the recognized standards with which they must comply, and other necessary details for their installation. The plasters allowed in the appendix have a history of successful use on cob and other earthen wall systems.

Non-plaster finishes systems are allowed with approved specifications that ensure: adequate attachment or support, the ability to safely discharge moisture, a minimum vapor permeance rating, and compliance with stated weight limits.

COB WALLS - GENERAL:

General limits are given for all cob buildings, including: one story; maximum building height of 25 feet; Seismic Design Categories A, B, and C (except with an approved engineered design); wall height and wall thickness limitations; and an approved engineered design for interior cob walls that addresses their seismic lateral loads (except in Seismic Design Category A).

A method of out-of-plane resistance is required for all walls, and wall height limits are given. Bond beams are required and described for all cob walls, as are lintels over door and window openings. Reinforcing at window and door openings is required for openings wider than 2 feet. Window openings are limited to 6 feet in width and horizontal and vertical reinforcing at window and door openings is required and described. A minimum cob wall length between openings is given and reinforcing required to ensure the wall's stability.

Moisture control requirements address potential moisture intrusion from rain or snow, or through capillary action from the ground and help ensure that moisture that might enter is not trapped. That protection includes limiting the use of membranes and barriers between the cob and plaster finishes. Limiting the use of membranes also enables a mechanical bond between the plaster and the cob.

A Class I or II vapor retarder is required between the bottom of the cob wall and the foundation to prevent ground moisture from rising into the wall, unless the particular project conditions and design eliminate this need. A minimum separation of the cob wall above finished grade is required. Protection of horizontal surfaces is required to prevent erosion and water intrusion.

Requirements for installing windows and doors are given so they are secure and prevent the passage of air or moisture through or into the wall.

In addition to inspections normally required, inspections specific to cob construction are required for the anchors connecting cob walls to the

foundation and the bond beam, for required vertical or horizontal reinforcing in the walls, and for reinforcing in any concrete bond beams or lintels.

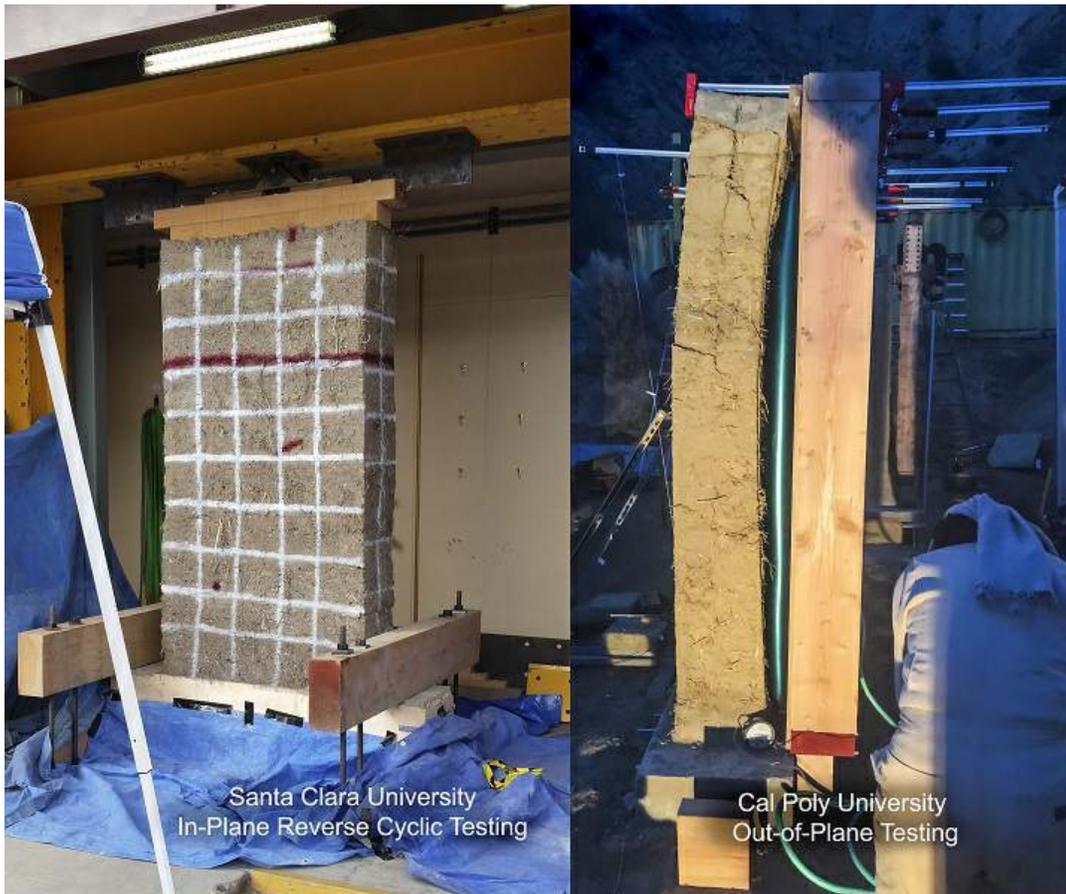
COB WALLS - STRUCTURAL:

Cob walls are a compression dominant wall system containing a micro-reinforcing system of straw throughout. Testing has shown this increases ductility compared to earthen materials with no straw. Cob can be reinforced with other standard reinforcing materials such as steel bar and welded wire mesh, making it akin to concrete construction in this respect. Cob wall systems using these reinforcing materials are included in the proposed appendix.



First Permitted Cob Structure in Berkeley, California Under Construction

University and independent lab structural tests on cob have been conducted and documented since the 1990s. Testing this proposed code has used as the bases of its analysis include: In-Plane Reverse Cyclic Tests as well as small scale batch testing at Santa Clara University; Small Scale batch testing at the University of Plymouth (England); Federal Institute for Materials Research and Testing, Berlin, Germany; The University of Oregon; Wuhan University of Technology, China; the University of San Francisco; and the Washington State University. Shake table test results were also used from the University of Sydney (Australia), and the University of British Columbia (Canada).



This proposed code also drew on the following codes, standards and earthen engineering texts: ASTM E2392 Standard Guide for Design of Earthen Wall Building Systems; the engineered and prescriptive New Zealand Standard for Earth Buildings NZS4297-99; The New Mexico Earthen Building Materials Code; the prescriptive German Earthen Building Standard, DIN 4102; and earthen engineering texts such as Building with Earth: Design and Technology of a Sustainable Architecture, by Gernot Minke.

Gravity load-bearing values are based on project specific, required material tests. Lateral loads are limited to Seismic Design Categories (SDC) A, B, and C, with increased safety factors and decreased Response Modification Factors for SDC C. Gravity and earthquake effects of the cob weight itself have been generated assuming a material density of 110 pcf which is the upper limit of density for all tests assessed. A common density range of 80-105 pcf is expected in the field. Appropriate adjustment factors have been applied for other structural elements and connections contained in other parts of the IRC that may be uniquely affected by the increased dead load of cob walls, such as the roof diaphragm. A full report of the structural analysis that generated this proposed appendix is available at: <https://www.cobcode.org/cobcode-documents>

COB FLOORS:

Cob floors on grade, with or without straw, are permitted in cob buildings, but the specifications must be approved by the building official. There are numerous viable cob floor systems. The modern evolution and growing use of cob and other earthen floors in high-end custom homes is testament to their serviceability, aesthetic appeal, and low environmental impact.

FIRE RESISTANCE:

ASTM E119 Fire-Resistance Rating Equivalency for Monolithic Adobe (Cob) walls.

To establish the minimum 1-hour fire resistance rating for a 10" thick cob wall included in this appendix, extensive research was done into existing ratings in codes and standards, testing, and fire experience in earthen wall buildings. A technical equivalency evaluation was conducted by Reax Engineering, Inc., which is summarized below. In addition, it is worth noting that in Australia as in the western U.S., devastating wildfires, or bushfires as they are called in Australia, have been increasing in frequency and intensity. Because of a tradition of buildings with earthen walls in areas that have experienced the most intense bushfires, they have had the opportunity to observe how earthen walls perform in firestorms.



Two-story loadbearing earth brick house following the 2009 "Black Saturday" bushfires in Victoria, Australia

The Australian Standard AS 3959-2009, "Construction of buildings in bushfire-prone areas," was developed as a result. This standard lists "earth wall including mud brick" as one of only three external wall materials not needing additional testing even in the most extreme and vulnerable bushfire zones, BAL FZ (Bushfire Attack Level- Flame Zone). The standard stipulates that the exposed components of external walls shall be of non-combustible material at least 90mm (3.54 inches) thick. Along with earth walls, the other materials listed as acceptable without additional testing for external walls are full masonry and precast or in situ concrete. The minimum 10-inch thick 1-hour cob wall in this proposed appendix is almost three times as thick as the minimum thickness of the earth wall accepted by that standard for the highest fire risk zones in Australia.

Additionally, the Australian Earth Building Handbook, HB195-2002, in Section 4.6 Fire Resistance Level, states, "In the absence of specific test data, the general fire resistance level (FRL) of earth walls satisfying the minimum thickness requirements outlined in Clause 4.3.4 may be taken as not greater than 120/120/120, or 90/90/90 where wall thickness is less than 200 mm." Clause 4.3.4 Structural Adequacy states: "Minimum recommended thicknesses for mud brick, stabilized pressed block and rammed earth are as follows: External walling - 200 mm, Internal walling - 125 mm. The minimum wall thickness for poured earth and cob wall construction is also recommended to be 200 mm, though in practice wall thickness will often exceed this value."

The three numbers in the FRL represent minutes before failure for structural adequacy/integrity/insulation. In other words the time for the wall to be able to maintain a load, maintain its integrity, and before heat increase on the unheated side of the wall exceeds accepted limits. Thus Australia gives a 2-hour fire resistance rating for a 200 mm (7.87") earth wall. This Standards Australia handbook is available via the supporting documents link above.

Summary of the Reax Engineering Inc. evaluation and analysis of historical tests and other relevant evidence to determine a fire-resistance rating equivalency for cob walls.

Code Requirement

IRC Section R302.1 Exterior Walls and Table R302.1(1) requires 1-hour fire-resistance rated walls to be tested in accordance with ASTM E119 or UL 263 with exposure from both sides. E119 fire-resistance ratings ≥ 1 hour must include a one-minute hose stream test following the fire-resistance test.

Proposed Equivalency

ASTM E119 and equivalent international tests AS 1530 and EN 1363 on closely-related compressed earth block and adobe block walls, were used to demonstrate a minimum of 1-hour fire resistance of Monolithic Adobe (Cob) walls greater than or equal to 10 inches thick, including a significant factor of safety.

Rational Engineering Analysis of Proposed Equivalency

Reax Engineering Inc. evaluated results from standardized testing, published standards, and empirical evidence, to establish a conservative

minimum value for the fire resistance of monolithic adobe (sand, straw and unfired clay in monolithic form). Data was from allied construction systems using the same sand, clay, straw materials in brick form (brick and monolithic walls of these materials are referred to collectively as “earthen walls”).

The tests are described below and summarized in Table 1. All tests except test (c) (run to insulation failure) passed all parameters tested: loadbearing, integrity, insulation. Test (a) also included and passed a hose stream test. All wall specimen sizes were 10' x 10' or the close metric equivalent of 3.1 x 3.1 meters.

Test Descriptions

a. A test of a 10” thick, compressed earth block wall was conducted in 2013 in Texas to the ASTM E119 2-hour load-bearing standard. Results for the test including the hose stream component are proprietary but a video is available at the following link: [Urban Earth Fire Resistance Test \(video\)](#)

b. A test of a 9.84” thick compressed earth block wall was conducted in 2011 in South Africa to a 1-hour standard using an ISO 834 time/temperature curve identical to the ASTM E119 temperature curve. This test provided the basis for a 2-hour loadbearing fire-resistance rating for 9.84” thick compressed earth block wall.

c. A test of a 5.9” thick Cinva-ram earth block wall was conducted in Australia to insulation failure at 3 hrs 41 minutes, to the AS1530.4 standard. It was reported in the Commonwealth Scientific and Industrial Research Organization’s (CSIRO) Bulletin 5: Earth Wall Construction, 1976. CISRO is an independent Australian federal government agency responsible for scientific research.

d. A test was conducted in Australia in 1982 to the AS1530.4-1975 4-hour standard, which is nearly identical to the ASTM E119 4-hour standard. The test provided a 4-hour loadbearing fire-resistance rating for a 9.8” thick adobe block wall. The test was stopped after 4 hours. Researchers extrapolated a 6 to 7-hour rating had the test continued, with heat rise on the unexposed face the predicted limiting factor.

e. A test of a 5.9” thick walls was conducted at the Laboratory for Structures and Fire Resistance at the University of Aveiro, Portugal, using ISO 834 time-temp curve and the European Standards for testing fire resistance (EN1363-1 and EN 1364-1). One wall tested soil stabilized with cement, and one tested soil stabilized with Kraft fibers.

Table 1. Summary of Testing

Test	Material	Rating (hours) / Test duration (hours)	Load Bearing	Hose Stream	Thickness (in.)	Standard / Variation from E119
a	Compressed Earth Block	2.0 / 2.4	Y	Pass	10	ASTM E119 / no variation
b	Compressed Earth Block	2.0 / 2.4	Y	Not done	9.84	ISO 834 / Nearly identical to ASTM E119
c	Ram Earth Block	3.6 / 7.3	Y	Not done	5.9	AS 1530-1975 / Based on ISO 834
d	Adobe Block	4.0 / 4.9	Y	Not done	9.8	AS 1530-1975 / Based on ISO 834

e	Compressed Earth Block	2.0 / 4.1	N	Not done	5.9	EN 1363-1 w ISO 834 time temp curve to 120 minutes
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Several of these tests are on compressed earth block systems which lack the straw component of cob wall construction. Straw adds resistance to heat transfer thus decreasing the rate of surface temperature rise on the unexposed side. Straw in the wall will not combust due to lack of oxygen, and it will continue to offer its primary role in adobe of limiting crack propagation, a property expected to enhance a cob wall's resistance to thermally induced structural failure.

As a massive system, a monolithic adobe wall can absorb a significantly greater amount of heat when compared to a standard stuccoed wood-framed wall. For slow growing fires, this translates to less heat on the interior, and prolonged time to flashover with increased protection and time for escape.

Photos were reviewed of surviving earthen walls with completely incinerated wooden floor and roof structures in California and Australian firestorms. These show further evidence of the resistance of earthen wall systems to intense fire conditions.

Monolithic adobe is used to construct fireplaces, ovens, kilns, and forges, a testament to its ability to contain fire. It is favored for these applications over concrete, rock, and red brick, for its lesser tendency to crack or spall.

Comparison to Tests and Adopted Standards

The engineering judgment was checked against standards from two jurisdictions with prescribed fire-resistance ratings for earthen walls. The Pima County Approved Standard for Earthen IBC Structures, provides a 2-hour rating for a 10" thick wall. New Zealand's NZS 4297 Engineering Design of Earth Buildings provides a 2-hour rating for a 5.9" thick wall. Thus an engineering judgment of a 1-hour fire-resistance rating for a 10" thick monolithic adobe wall provides a 100% safety margin compared to these standards and as compared to four of the five described tests. A 1-hour rating provides a 300% safety margin compared with the Australian adobe block test that yielded a 4-hour rating.

Conclusion

All relevant evidence strongly supports the judgment that monolithic adobe (cob) walls constructed to a minimum thickness of 10 inches provide a conservative minimum fire-resistance rating of 1-hour.

Fire testing reports, related documents and the equivalency report are available at <https://www.cobcode.org/cobcode-documents>

THERMAL PERFORMANCE:

Cob walls are classified as mass walls in accordance with Section N1102.2.5 because the heat capacity of cob walls is greater than the 6 Btu/ft² x °F threshold defined in that section. The lowest heat capacity of a cob wall is 16 Btu/ft² x °F, for the required minimum wall thickness of 10" and at the lowest practical density of 70 pcf.

Cob's assigned unit R-value of 0.22 per inch with a density of 110 pcf was determined with an ASTM C1363 thermal resistance test at Intertek Laboratory in Fresno, CA in December 2018. The R-value of the wall assembly is determined by adding the thermal resistance of the air films and any finish or additional insulation.

Adding insulation to the face of cob walls can allow them to be used more readily in cold climates. This is allowed, providing the insulation assembly complies with the requirement in Section AU104.1 for attachment or support, vapor permeance, and weight limits.

Bibliography: *The following documents relate to one or more categories in the code proposal as indicated: General (G), Structural (S), Fire (F).* Australian Earth Building Handbook, HB195-2002, Peter Walker, Standards Australia. G, S, F

CSIRO-Australia, Bulletin 5 Earth-Wall Construction 4th Edition, 1992 Division of Building Construction and Engineering. G, S, F

AS 3959-2009, Australian Standard Construction of Buildings in Bushfire Prone Areas, (incorporating Amendments 1, 2 and 3), Standards Australia, 2009-2011. S, F

NZS 4297.1998 Engineering Design of Earth Buildings, Standards New Zealand, 1998. S, F

NZS 4298.1998, Materials and Workmanship for Earth Buildings, Standards New Zealand, 2000 (incorporates June 2000 Amendment). G, S

NZS 4299.1998, Earth Buildings Not Requiring Specific Design, Standards New Zealand, 1999 (incorporates December 1999 amendment). G, S

"NZS 4297-99, The New Zealand Earth Building Standards: Their History and Current Status," Graeme North and Min Hall, 2018. G, S

"Moisture Properties of Plaster and Stucco for Strawbale Buildings," John Straube, PE, 2003 G

CSIRO EBS Technical Record 490, "Fire-Resistance Test on a Loadbearing Masonry Wall of 250mm-Thick Adobe Blockwork," Experimental Building Station, Australia, 1982. F

AS 1530 Part 4-1975 Fire Tests on Building Materials and Structures: Part 4-Fire-Resistance Tests of Structures, Standards Association of Australia, 1975. F

"Review of Rammed Earth Construction: Developing Rammed Earth for UK Housing," Vasilios Maniatidis, Peter Walker, Natural Building Technology Group, University of Bath, 2003 G, S, F

Keynote Address, "Rammed Earth Building in (western) Australia and Earthbuilding worldwide," Earth Building Association of Australia, Stephen Dobson, 2009. F

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"Fire resistance of walls made of soil-cement and Kraftterra compressed earth blocks," M. Buson, N. Lopes, H. Varum, R. M. Sposto, P. Vila Real, 2012. G, S, F

Tucson-Pima County Arizona Earthen Building Code. 1997. G, S, F

New Mexico Earthen Building Code, 2009. G, S, F

"Evaluation of ASTM E119 Fire Rating Equivalency for Monolithic Adobe (Cob) Walls," David Rich, Reax Engineering, 2019. F"ASTM 1-Hour E-119 Non-Bearing Straw Bale Clay Plastered Wall," Intertek Test Report, 2007. F

ASTM E2392-10 Standard Guide for the Design of Earthen Wall Systems. G, S

"Cob: A Sustainable Building Material," D. Eberhard, J. Novara, B. Popovec, Santa Clara University Department of Civil Engineering, 2018. S

"Cob Property Analysis," G. Brunello, J. Espinoza, A. Golitz, Santa Clara University Department of Civil Engineering, 2018. S

Building With Earth: Design and Technology of Sustainable Architecture, Gernot Minke, 2006. G, S

"Transforming building regulatory systems to address climate change," David Eisenberg, Building Research and Information, 2016. G

Cost Impact: The code change proposal will not increase or decrease the cost of construction
 As a wall system cob can be more costly or less costly than conventional wall systems found in the IRC, depending on many variables. The materials for cob walls or clay soil (often from the site), sand, and straw are relatively inexpensive whereas the cob walls can be more labor intensive. Other elements or systems in the building such as the foundation, roof, electrical, plumbing and mechanical can be very similar to those used in conventional construction and therefore the same cost. As an overview this proposal will not affect the cost of construction.

RB299-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is a lot of information to take in here. There are still questions regarding the fire rated assemblies, the efficiency....etc. It says to comply with this code. There is not a good pathway that allows some of the items in this type of construction to comply with that. This has to be addressed. This is a style of construction that goes back hundreds or years and a lot of effort went into this proposal, but it still needs to get better. The assumed 1 hour fire-resistance rating is not supported by tests. We cannot extrapolate from small scale testing. The committee encourages the proponents to continue the development of the proposal. The coordination effort is impressive. We need construction that will meet

the challenges of wildfires. Australian experts contacted indicate that houses constructed in accordance with AS 3959 may burn down during a brush fire, but if the residents survive the initial fire front, it is seen as success for the standard. Houses constructed to AS 3959 have a much better chance of surviving a brush fire than others. This type of construction has been successful. But we need to see full scale test results. The committee looks forward to further development in the public comment period. (Vote: 10-1)

Assembly Action:

None

RB299-19

Individual Consideration Agenda

Public Comment 1:

IRC®: APPENDIX U (New), AU104.1 (New), AU104.1.1 (New), AU104.1.2 (New), AU105.2 (New), TABLE AU105.3 (New), AU105.5 (New), AU106.2 (New), AU106.9.1.3 (New), AU106.9.5 (New), Figure AU106.9.5 (New), AU106.9.6 (New), Figure AU106.9.6 (New), AU106.11.1 (New), AU106.11.2 (New), TABLE AU106.11(2) (New), TABLE AU106.11(3A) (New), AU106.11(3B) (New), AU106.11(3C) (New), AU108.1 (New)

Proponents:

Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); Anthony Dente, representing Verdant Structural Engineers (anthony@verdantstructural.com); David A Eisenberg, DCAT, representing DCAT (strawnet@gmail.com); JOHN FORDICE, representing Cob Research Institute (jfordice@cobcode.org); Michael Smith, representing Cob Research Institute (michael@strawclaywood.com); Art Ludwig, Oasis Design, representing Oasis Design; William Kelley, Marin County Community Development Agency, representing Marin County Community Development Agency (bkelly@marincounty.org); Glenn Schainblatt, City of Sebastopol, representing County Building Officials Association of California (gschainblatt@cityofsebastopol.org); David Rich, representing Reax Engineering (rich@reaxengineering.com); Kevin Donahue, Verdant Structural Engineers, representing Kevin Donahue Structural Engineer (kevin@verdantstructural.com); Ben Loescher, representing Self (bloescher@lmarchitectsinc.com); Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

APPENDIX U Cob Construction (Monolithic Adobe)

AU104.1 General. Cob walls shall not require a *finish*, except as required by Section AU104.2. Finishes applied to cob walls shall comply with this section and with Chapters 3 and 7 unless stated otherwise in this section.~~be plasters in accordance with Section AU104.4, non-plaster exterior wall coverings in accordance with Section R703 or other finish systems in accordance with the following:~~

- ~~1. Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.~~
- ~~2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.~~
- ~~3. Finish systems with weights >10 and ≤ 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m²) of wall shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.~~
- ~~4. Finish systems with weights > 20 pounds per square foot (> 97.8 kg/m²) of wall area shall require an engineered design.~~

AU104.1.1 Interior wall finishes. Where installed, interior wall finishes and interior fire protection shall comply with the applicable provisions of Section R302, and shall be plasters in accordance with Section AU104.4, or non-plaster wall coverings in accordance with Section R702 .

AU104.1.2 Exterior wall finishes. Where installed, exterior wall finishes shall be plasters in accordance with Section AU104.4, or non-plaster exterior wall coverings in accordance with Section R703, or other finish systems in accordance with the following:

1. Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.
2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.
3. Finish systems with weights >10 and ≤ 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m²) of wall shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.
4. Finish systems with weights > 20 pounds per square foot (> 97.8 kg/m²) of wall area shall require an engineered design.

AU105.2 Building limitations and requirements for cob wall construction. Cob walls shall be subject to the following limitations and requirements:

1. Number of stories: not more than one.

2. *Building* height: not more than ~~25.20~~ 20 feet (~~7620~~ 6096 mm).
3. Seismic design categories: limited to use in Seismic Design Categories A, B and C, except where an *approved* engineered design is provided.
4. Wall height: in accordance with Table ~~AU105.4~~ AU105.3, and with Table AU106.11(1) for *braced wall panels*.
5. Wall thickness, excluding finish, shall be not less than 10 inches, not greater than 24 inches at the top two-thirds, not limited at the bottom third and, for structural walls, shall comply with Section AU106.2(2). Wall taper is permitted in accordance with Section AU106.5(1).
6. Interior *cob* walls shall require an *approved* engineered design that accounts for the seismic load of the interior *cob* walls, except in Seismic Design Category A for walls with a height to thickness ratio \leq to 6.

TABLE AU105.3 OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL HEIGHT LIMITS

WALL TYPE ^{a, g, h} and METHOD OF OUT-OF-PLANE LOAD RESISTANCE	FOR ULTIMATE DESIGN WIND SPEEDS (mph)	FOR SEISMIC DESIGN CATEGORIES	UNRESTRAINED COB WALL HEIGHT H ^{b, c}		TOP ANCHOR ^e SPACING (inches)	TENSION TIE ^f SPACING (inches)
			Absolute limit in feet	Limit based on wall thickness T ^d in feet		
Wall 1 ⁱ : no anchors, no steel wall reinforcing	≤ 110	A	$H \leq 8$	$H \leq 6T$	none	48
Wall 2: top anchors ^j , continuous vertical 6"x6"x6 gage steel mesh in center of wall embedded in foundation 12"	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24
Wall A ⁱ : top anchors, no vertical steel reinforcing	≤ 120	A, B	$H \leq 8$	$H \leq 6T$	12	48
Wall B ⁱ : top & bottom anchors, no vertical steel reinforcing	≤ 130	A, B	$H \leq 8$	$H \leq 6T$	12	48
Wall C: top and bottom anchors, continuous vertical threaded rod at 4' oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24
Wall D: continuous vertical threaded rod at 1' oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	NA	24
Wall E: top anchors, continuous vertical 6"x6"x6 gage steel mesh 2" from each face of wall embedded in foundation	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

N/A = Not Applicable

- a. See Table AU106.11(1) for reinforcing and anchorage specifications for wall types A, B, C, D and E.
- b. H = height of the cob portion of the wall only. See Figure AU101.4. The maximum H is the absolute limit or the limit based on wall thickness, whichever is more restrictive.
- c. Bond beams or other horizontal restraints are capable of separating a wall into more than one unrestrained wall height with an *approved* engineered design.
- d. T = Cob wall thickness (in feet) at its minimum, without plaster.
- e. 5/8-inch threaded rod anchors at prescribed spacing with 12" embedment in cob, full embedment in concrete bond beams or full penetration in wood bond beam with a nut and washer.
- f. Attach rafters to bond beam with 4-inch by 3-inch by 3-inch by 18 gage tension tie angles at prescribed spacing. See Figure ~~R608.9(9)~~ AU106.9.5. Where rafters are attached to tension ties shall, roof sheathing shall be edge nailed.
- g. All walls shall be tested for compressive strength in accordance with Section AU106.6.
- h. For curved walls with an arc length:radius ratio of 1.5:1 or greater, the H/T factor shall be increased by 1, and the absolute height limit by 1 foot.
- i. Wall type requires a modulus of rupture test in accordance with Section AU106.7.
- j. See wall type A in Table AU106.11(1) for top anchor requirements.

AU105.5 Inspections. The *building official* shall inspect the following aspects of *cob construction* in addition to the required tests of, and accordance

with Section R109.1:

1. Anchors and vertical and horizontal reinforcing in *cob* walls, where required in accordance with Tables ~~AU105.2~~ AU105.3 and AU106.11(1) and Sections AU105.3.4 and AU105.3.5.
2. Reinforcing in any concrete bond beams or lintels, in accordance with Sections AU106.9.2 and Table AU106.10.

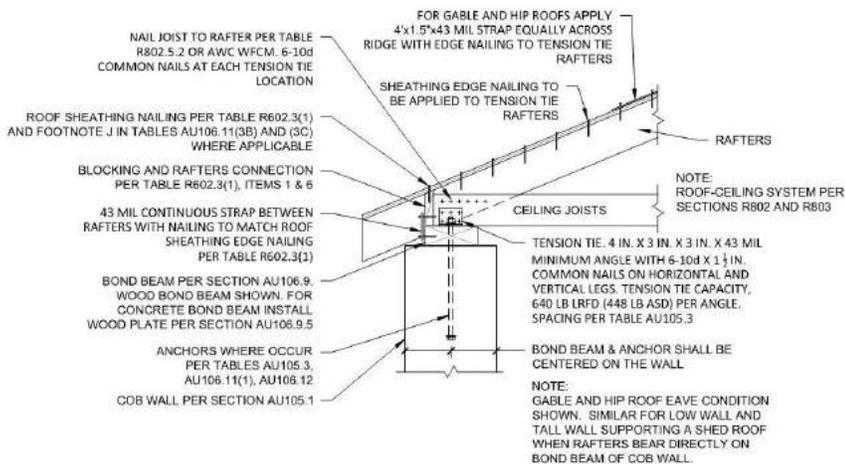
AU106.2 Requirements for cob structural walls. In addition to the requirements of Section AU105.2, *cob structural walls* shall be subject to the following:

1. Wall height: shall be in accordance with Table AU105.3 for load-bearing cob walls or AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
2. Wall thickness: shall be in accordance with Section AU105.2(5) and Section AU106.8.1 for load-bearing cob walls or Table AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
3. *Braced wall panel* lengths: for *buildings* using *cob braced wall panels*, the greater of the values determined in accordance with Tables AU106.11(2) for wind loads and AU106.11(3A), AU106.11(3B), or AU106.11(3C) for seismic loads shall be used.

AU106.9.1.3 Corners and curved walls. Wood bond beams at corners and discontinuities atop curved walls shall be connected across their exterior faces with a metal strap with a capacity of not less than that determined ~~in~~ in accordance with Section AU106.9.1.2.

AU106.9.5 Connection of roof framing to bond beams. Roof and ceiling framing shall be attached to bond beams in accordance with Table R602.3(1), Items 2; ~~and 6, 30, 31 and 32~~ and Figure AU106.9.5. Roof sheathing shall be attached to roof framing in accordance with Figure AU106.9.5. Tension ties shall be provided in accordance with Figure R608.9(9) and Footnote f of Table AU105.3. 10d toe nails at 6 inches (152 mm) on center shall be provided from the rim blocking to top plate for the entirety of braced wall lines, instead of the 43 mil strap shown in Figure R608.9(9). A minimum nominal 2-inch by 6-inch (51 mm by 152 mm) wood plate shall be installed on concrete bond beams with 5/8-inch (16 mm) diameter anchor bolts with 5-inch (127 mm) embedment at 2 feet (610 mm) on center to allow the required fastening of roof and ceiling framing, including tension ties and ~~straps~~ toe nailing of rim blocking.

Figure AU106.9.5 Connection Of Roof Framing To Bond Beams

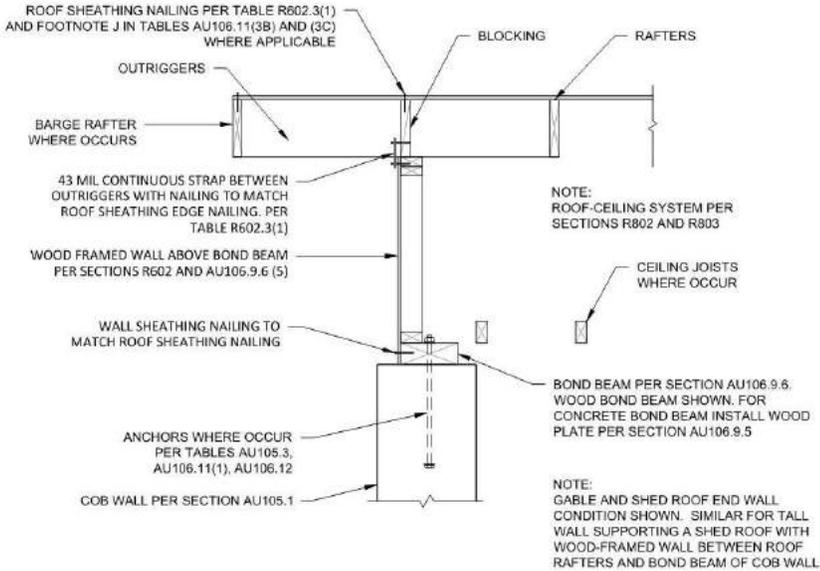


AU106.9.6 Bond beams and connections at gable and shed roof end walls. Bond beams and connections at end walls of buildings with gable roofs ~~or~~ and shed roofs shall comply with Figure AU106.9.6 and the following:

1. End walls shall not exceed 20 feet (6096 mm) in length.
2. ~~Shall~~ Bond beams shall be continuous and straight for the entire wall line.
3. Wood bond beams when used shall comply with the following:
 - 3.1. Not less than nominal 4x8 (102 mm by 203 mm) when wind design governs in accordance with Tables ~~AU106.11(2)~~, and when seismic design governs in accordance with Tables AU106.11(3A), AU106.11(3B), or AU106.11(3C), ~~and~~ for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category A, ~~and for or~~ wall lengths ≤ 10 feet (3048 mm) in Seismic Design Categories B and C.
 - 3.2. Not less than nominal 4x10 (102 mm by 254 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category B.
 - 3.3. Not less than nominal 6x12 (152 mm by 305 mm) or 4x16 (102 mm by 406 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category C.
- 3.4. Corners shall be connected in accordance with Section AU106.9.3.

4. Concrete bond beams when used shall be in accordance with Section AU106.9.2 in Seismic Design Categories A, B, and C and for ultimate design wind speeds ≤ 140 mph (63.6 m/s).
5. Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602. The ratio of its largest height to its length shall not exceed 1:2. The wall shall contain no openings.

Figure AU106.9.6 Connections At Gable And Shed Roof End Walls



AU106.11.1 Non-orthogonal braced wall panels. *Braced wall panels* at an angle to the orthogonal braced wall lines shall be considered to contribute to the minimum total braced wall lengths in Tables AU106.11(2), ~~and AU106.11(3A), AU106.11(3B), and AU106.11(3C)~~ as follows:

1. A braced wall panel not more than 45 degrees and greater than 30 degrees to an adjacent orthogonal braced wall line shall contribute 50% of its length to that line.
2. A braced wall panel not more than 30 degrees to an orthogonal braced wall line shall contribute 65 percent of its length to that line.
3. A braced wall panel greater than 45 degrees and not more than 60 degrees to an orthogonal braced wall line shall contribute 35 percent of its length to that line.
4. The angle of a curved braced wall panel to a braced wall line shall be determined with the chord of that section of wall, connecting the end points of the arc at the center of the wall.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved *cob* walls shall contain two braced wall lines in two orthogonal directions. The spacing of the braced wall lines for wind design in Table AU106.11(2) and the spacing and length of the braced wall lines for seismic design in Table AU106.11(3A), AU106.11(3B) and AU106.11(3C) shall be the maximum widths of the building in the two orthogonal directions.

TABLE AU106.11(2) BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON WIND SPEED

EXPOSURE CATEGORY B ^d			MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d}			
• 25-FOOT MEAN ROOF HEIGHT						
• 10-FOOT EAVE-TO-RIDGE HEIGHT ^d						
• 10-FOOT WALL HEIGHT ^d						
• 2 BRACED WALL LINES ^d						
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Cob braced wall panel ^e A (aspect ratio H:L \leq 1:1)	Cob braced wall panel ^e B (aspect ratio H:L \leq 1:1)	Cob braced wall panel ^e C, D (aspect ratio H:L \leq 2:1)	Cob braced wall panel ^e E (aspect ratio H:L \leq 1:1)

10 ≤ 110	6-0 One-story building	6-0 10	3-7 6.0	NP 6.0	3.7	6.0
≤ 110	One-story building	20	7.9	7.4	7.4	NP 6.0
30 ≤ 110	11-8 One-story building	11-0 30	11-0 11.8	NP 11.0	11.0	6.9
10 ≤ 115	6-0 One-story building	6-0 10	4-1 6.0	NP 6.0	4.1	6.0
≤ 115	One-story building	20	8.7	8.1	8.1	NP 6.0
30 ≤ 115	13-0 One-story building	12-1 30	12-1 13.0	NP 12.1	12.1	7.6
10 ≤ 120	6-0 One-story building	6-0 10	4-4 6.0	NP 6.0	4.4	6.0
≤ 120	One-story building	20	9.4	8.8	8.8	NP 6.0
30 ≤ 120	14-1 One-story building	13-1 30	13-1 14.1	NP 13.1	13.1	8.3
10 ≤ 130	6-0 One-story building	6-0 10	5-1 6.0	NP 6.0	5.1	6.0
≤ 130	One-story building	20	11.0	10.3	10.3	NP 6.5
30 ≤ 130	16-5 One-story building	15-4 30	15-4 16.5	NP 15.4	15.4	9.7
10 ≤ 140	6-0 One-story building	6-0 10	5-9 6.0	NP 6.0	5.9	6.0
≤ 140	One-story building	20	12.7	11.9	11.9	NP 7.5
30 ≤ 140	19-1 One-story building	17-8 30	17-8 19.1	NP 17.8	17.8	11.2

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

- a. Linear interpolation shall be permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.
- d. Subject to applicable wind adjustment factors associated with Items 1 and 2 of Table R602.10.3(2)
- e. Cob braced wall panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

TABLE AU106.11(3A) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY A

<ul style="list-style-type: none"> • SOIL CLASS D^{ef} • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY A • 1.5" PLASTER THICKNESS EACH SIDE^{hg} 	MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d, e}
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Braced wall line spacing (feet)	Braced wall line length (feet)	Min. Braced wall line % openings	Min. Perpendicular braced wall line % openings	Cob-braced wall panel ^e A, B	Cob-braced wall panel ^e C, D	Cob-braced wall panel ^e E
10	30	Any % ^g 0	Any % ^g 0	Wind ^f	Wind ^f 3.4	NP 6.0
20	20	Any % ^g 0	Any % ^g 0	Wind ^f	Wind ^f 3.5	NP 6.0
20	30	Any % ^g 0	Any % ^g 0	Wind ^f	4.5	NP 6.0
30	30	Any % ^g 0	Any % ^g 0	Wind ^f	Wind ^f 5.6	NP 6.0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.
- d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).
- e. Cob braced panel types indicated shall comply with Sections ~~AU106.11-1 and AU106.11-2~~ and Table AU106.11(1).
- f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.
- g. ~~Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).~~
- h. ~~g.~~ For total plaster thickness between 3-inches and 6-inches, the minimum total length of braced wall panels shall be multiplied by 1.2.
- i. ~~The minimum total braced wall panel length shall be governed by Table AU106.11(2).~~

AU106.11(3B) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY B

<ul style="list-style-type: none"> • SOIL CLASS D^{ef} • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY B • 1.5" PLASTER THICKNESS EACH SIDE^{hg} 	MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d, e}
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Braced wall line spacing (feet)	Braced wall line length (feet)	Min. Braced wall line % openings	Min. Perpendicular braced wall lines % openings	Cob-braced wall panel ^o A, B	Cob-braced wall panel ^o C, D	Cob-braced wall panel ^o E
10	10	Any % ^g 0	Any % ^g 0	Wind ^h 6.0	Wind ^h 3.2	NP 6.0
10	20	0	Any % ^g 0	6.0	4.9	NP 6.0
10	20	50	Any % ^g 0	6.0	Wind ^h 3.5	NP 6.0
10	30	0	Any % ^g 0	7.1	6.6	NP 6.0
10	30	50	Any % ^g 0	6.0	4.5	NP 6.0
20	10	0	0	6.0 ^h	4.9 ^h	NP 6.0
20	10	0	50	6.0	Wind ^h 3.5	NP 6.0
20	10	50	Any % ^g 0	6.0 NP	4.2	NP
20	10	50	50	6.0 NP	4.2 3.0	NP
20	20	0	0	7.4	6.9	NP 6.0
20	20	0	50	6.0	5.5	NP 6.0
20	20	50	0	6.0	5.5	NP 6.0
20	20	50	50	6.0	4.1	NP 6.0
20	30	0	0	9.4	8.8	NP 6.0
20	30	0	50	7.9	7.4	NP 6.0
20	30	50	0	7.2	6.7	NP 6.0
20	30	50	50	6.0	5.3	NP 6.0
30	10	Any % ^g 0	Any % ^g 0	Wind ^h 7.1	Wind ^h 6.6	NP 6.0
30	20	0	0	9.4	8.8	NP 6.0
30	20	0	50	Wind ^h 7.2	Wind ^h 6.7	NP 6.0
30	20	50	Any % ^g 0	7.9	Wind ^h 7.4	NP 6.0
30	30	0	0	11.8	11.0	NP 6.0
30	30	0	50	9.5	8.9	NP 6.0
30	30	50	0	9.5	8.9	NP 6.0
30	30	50	50	Wind ^h 7.3	Wind ^h 6.8	NP 6.0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.
- d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4)
- e. Cob braced panel types indicated shall comply with Sections ~~AU106.11-1, AU106.11-2~~ and Table AU106.11(1).
- f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between *S_{ds}* values associated with the seismic design categories is allowable where a site-specific *S_{ds}* value is determined in accordance with Section 1613.3 of the *International Building Code*.
- ~~g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).~~
- ~~h. g.~~ For total plaster thicknesses 3-inches to 6-inches, the minimum total length of braced wall panels shall be multiplied by 1.2.
- ~~i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).~~

j. h. Total plaster thicknesses shall be not greater than 3-inches. Substitute 15/32" roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU106.11(3C) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY C

<ul style="list-style-type: none"> • SOIL CLASS D^{ef} • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SESIMIC DESIGN CATEGORY C • 1.5" PLASTER THICKNESS EACH SIDE^{hg} 				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE^{a, b, c, d, e}		
Braced wall line spacing (feet)	Braced wall line length (feet)	Min. Braced wall line % openings	Min. Perpendicular braced wall lines % openings	Cob-braced wall panel ^e A, B	Cob-braced wall panel ^e C, D	Cob-braced wall panel ^e E
10	10	0	0	8.3 ^h	7.8 ^h	NP 6.0
10	10	0	50	6.5	6.1	NP 6.0
10	10	25	0	7.4 ^h	6.9 ^h	NP 6.0
10	10	50	50	4.7 NP	4.4	NP 6.0
10	15	0	0	10.6	9.9	NP 6.0
10	15	0	50	8.7	8.2	NP 6.0
10	15	50	0	7.8 NP	7.3	NP 6.0
10	15	50	50	6.0	5.6	NP 6.0
10	20	0	0	12.8	11.9	NP 6.0
10	20	0	50	11.0	10.2	NP 6.0
10	20	50	0	9.1	8.5	NP 6.0
10	20	50	50	7.3	6.8	NP 6.0
15	10	25	0	9.6 NP	9.0 NP	NP 6.0 ^h
15	10	0	50	7.8	7.3	NP 6.0
15	10	50	0	8.7 NP	8.2 NP	NP
15	10	50	50	6.0 NP	5.6 NP	NP
15	15	0	0	12.9	12.1	NP 6.0
15	15	0	50	10.2	9.5	NP 6.0
15	15	50	0	10.2 NP	9.5 NP	NP 6.0
15	15	50	50	7.5	7.0	NP 6.0
15	20	0	0	15.3	14.3	NP 6.0
15	20	0	50	12.6	11.7	NP 6.0
15	20	50	0	11.7 NP	10.9 NP	NP 6.0
15	20	50	50	8.9	8.3	NP 6.0
20	10	25	0	NP	NP	NP
20	10	0	50	9.1	8.5	NP 6.0
20	10	50	Any % ^g 0	NP	NP	NP
20	10	50	50	7.3 NP	6.8 NP	NP
20	15	0	0	NP	NP 14.3 ^h	NP 6.0 ^h
20	15	0	50	11.7 ^h	10.9 ^h	NP 6.0
20	15	50	0	NP	NP	NP 6.0 ^h

20	15	50	50	8-9' NP	8-9' NP	NP 6.0
20	20	0	0	NP 17.8	NP 16.7	NP 6.9
20	20	0	50	14.2	13.3	NP 6.0
20	20	50	0	NP	NP	NP 6.0
20	20	50	50	NP	9.9	NP 6.0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.
- d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).
- e. Cob braced panel types indicated shall comply with Sections ~~AU106.11-1, AU106.11-2~~ and Table AU106.11(1).
- f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between *S_d* values associated with the seismic design categories is allowable where a site-specific *S_d* value is determined in accordance with Section 1613.3 of the *International Building Code*.
- ~~g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).~~

~~h. g.~~ For total plaster thicknesses 3" to 6", multiply the minimum total length of braced wall panels by 1.2.

~~i. h.~~ Total plaster thickness > 3" is not permitted. Substitute 15/32" roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU108.1 Fire-resistance rating. ~~Cob walls shall be considered to exhibit a 1-hour are not fire-resistance rated rating in accordance with the following:~~

- ~~1. Wall thickness shall be 10 inches (254 mm) or greater.~~
- ~~2. Density shall be 70 pcf (1121 kg/m³) or greater.~~
- ~~3. When used as a load-bearing wall, the maximum design load shall be 1000 pounds per lineal foot (14,590 N/m) in accordance with Section AS106.8.~~
- ~~4. When used as a braced wall panel, the wall shall be in accordance with Section AS106.11.~~

Commenter's Reason: This public comment does the following:

- Removes the fire-resistance rating for cob walls in the original proposal because a full ASTM E119 test to justify the rating had not been conducted. This addresses the primary reason for the IRC Committee's disapproval of the proposal.
- Incorporates the 3 Floor Modifications that were accepted and approved by the IRC Committee. These include a) reducing the maximum building height from 25' to 20', b) incorporating a Figure showing the structurally important top of wall to roof connection, and c) correcting braced wall panel lengths in Table AU106.11(3C) because of discoveries made between the original submittal and the IRC Committee Hearings.
- Adds a Figure showing structural connections for gable and shed roof end walls, based on input from two stakeholders subsequent to the IRC Committee Hearings.
- Adds braced wall panel lengths in four tables for Wall E. These values were not in the original proposal because the University testing results were not available at the time of submittal. They became available in time for this public comment.
- Adds language in Section AU104.1 to ensure compliance with sections of the code regarding fire-related requirements for interior finishes, as identified in testimony for a similar proposal.
- Corrects section number errors.

Together these modifications significantly improve the proposal, and address the IRC Committee's written comments and comments spoken during testimony at the IRC Committee Hearings.

There are two reasons the proposed IRC Appendix on Cob Construction (Monolithic Adobe) is urgently needed:

First, people are building unpermitted unsafe buildings with cob, including in high seismic zones, often after discovering how difficult it is to permit cob buildings because there is no cob building code.

Second, the increasing frequency and intensity of wildfires, especially in western states, is motivating elected officials, building officials, firefighters, design professionals, the insurance industry, homeowners, and entire communities to actively seek highly fire resistant building systems. Cob construction provides a very high level of fire resistance, as evidenced by the performance of cob and adobe buildings in intense Australian bush fires, and by related testing and research. Cob has been used for centuries to construct ovens and kilns. See the original proposal's Reason Statement for more on cob's exceptional fire resistance qualities.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As a wall system, cob can be more costly or less costly than conventional wall systems found in the IRC, depending on many variables. The materials for cob walls - clay-soil (often from the site), sand, and straw - are relatively inexpensive whereas the cob walls can be more labor intensive. Other elements or systems in the building such as the foundation, roof, electrical, plumbing and mechanical are typically similar to those used in conventional construction and therefore the same cost. Overall, this proposal and its public comment revisions will not affect the cost of construction.

Public Comment# 1611

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IRC@: Appendix U (New), SECTION AU101 (New), AU101.1 (New), AU101.2 (New), SECTION AU102 (New), AU102.1 (New), AU102.1.1 (New), AU102.1.2 (New), AU102.1.3 (New), AU102.1.4 (New), AU102.1.5 (New), SECTION AU103 (New), AU103.1 (New), AU103.1.1 (New), AU103.1.2 (New), SECTION AU104 (New), AU104.1 (New), SECTION AU105 (New), AU105.1 (New), AU105.1.1 (New), AU105.1.2 (New), AU105.1.3 (New), AU105.1.4 (New), AU105.1.5 (New), SECTION AU106 (New), AU106.1 (New)

Proposed Change as Submitted

Proponents: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com); David Allen, representing Edward Wayne Inc. (davidallen89@att.net); Ron Olberding, representing Edward Wayne Inc. (ronolberding@sbcglobal.net)

2018 International Residential Code

Add new text as follows:

Appendix U **Physical Security** **SECTION AU101** **General**

AU101.1 Purpose. The purpose of this appendix is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

AU101.2 Scope. The provisions of this appendix shall apply to all new structures and to additions and alterations made to existing buildings.

SECTION AU102 **Doors**

AU102.1 Doors. All exterior swinging doors of residential dwelling units and attached garages, including doors leading from the garage area into the dwelling unit, shall comply with Sections AU102.1.1 through AU102.1.5 based on the type of door installed.

Exceptions: Vehicular access doors.

AU102.1.1 Wood doors. Exterior wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.

AU102.1.2 Steel doors. Exterior steel doors shall be a minimum thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

AU102.1.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

AU102.1.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the door frame, or by other approved methods.

AU102.1.5 Sliding doors. Exterior sliding doors shall be installed to prevent the removal of the panels and the glazing from the exterior.

SECTION AU103 **Door Frames**

AU103.1 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Horizontal blocking shall be placed between studs at the door lock height for three stud spaces of equivalent bracing on each side of the door opening. Door frames shall comply with Sections AU103.1.1 through AU103.1.2 based on the type of door installed.

AU103.1.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelights, shall be reinforced in accordance with ASTM F476 Grade 40.

AU103.1.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel and reinforced at the hinges and strikes. Doors are to be anchored to the wall in accordance with the manufacturer's instructions.

SECTION AU104 **Door Jambs**

AU104.1 Door jambs. Door jambs shall comply with one of the following:

1. Door jambs constructed as per ASTM F476.
2. Door stops on wooden jambs for in-swinging doors shall be of one-piece construction.

SECTION AU105 **Door Hardware**

AU105.1 Door hardware. Exterior door hardware shall comply with Sections AU105.1.1 through AU105.1.5.

AU105.1.1 Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure shall be used. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

AU105.1.2 Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's interior side.

AU105.1.3 Locks. Exterior doors shall be provided with a deadbolt with a minimum grade 2 as determined by ANSI/BHMA.

AU105.1.4 Entry vision and glazing. All main or front entry doors to dwelling units shall be arranged so that the occupant has a view of the area immediately outside the door without opening the door. The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.

AU105.1.5 Side light entry doors. Side light doors units shall have framing of double stud construction or equivalent construction that complies with Sections AU103.1.1 or AU103.1.2. Double stud construction or equivalent construction shall exist between the glazing unit of the side light and the wall structure of the dwelling.

SECTION AU106 **Alternate Materials and Methods of Construction**

AU106.1 Alternate materials and methods of construction. The provisions of this appendix are not intended to prevent the use of any material or method of construction not specifically prescribed by this appendix, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this appendix. The materials, method of construction and structural design limitations provided for in this appendix shall be used unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this appendix.

Reason: In the summer of 1996, Overland Park, Kansas, experienced a series of home invasions resulting in the sexual assault of several women. For the victims of a home invasion, it's more than a property crime; it scares the victim into thinking that the criminal will return only to commit a more violent or heinous crime. To have an emotional investment in their residence is priceless.

As a result of these home invasions, the City's Police Department conducted hundreds of surveys of residents in an effort to develop a solution to the home invasions. The results of the surveys lead the City to develop a building code that makes home more safe and secure. You may ask, why secure the front door? What about installing an alarm? Communities across the country continue to report a growing increase in false alarms. In an effort to provide physical security to the homeowner, there needs to be a more reliable option available.

The longer a criminal spends trying to gain access to a home, the greater the risk of detection. In addition, most home invaders will not attempt to break a window, as that makes noise that neighbors could potentially hear. Rather than face these risks, the invader is more likely to try to kick in an exterior door, where they can easily gain access without being detected.

This code change will provide for minimal provisions to be made to a new home under construction that will give the homeowner safety and peace of mind, while delaying and frustrating the criminal. Since this proposal is not dependent on electrical power, these provisions will always be available to the homeowner and will require no further action after installation. There is no on-going cost to the homeowner and these provisions will not affect the overall aesthetics of the home.

Cost Impact: The code change proposal will increase the cost of construction
The cost to secure a single door ranges from \$40-\$60 for a single door unit and between \$140 and \$180 for a double sidelite unit.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM F476 and ANSI/BHMA, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB300-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This should be an appendix, but it still needs work, as indicated in the committee's reason for disapproval of RB161-19. (Vote: 9-2)

Assembly Action:

None

RB300-19

Individual Consideration Agenda

Public Comment 1:

IRC®: Appendix U (New), SECTION AU101 (New), AU101.1 (New), AU101.2 (New), SECTION AU102 (New), AU102.1 (New), AU102.1.1 (New), AU102.1.2 (New), AU102.1.3 (New), AU102.1.4 (New), AU102.1.5 (New), SECTION AU103 (New), AU103.1 (New), AU103.1.1 (New), AU103.1.2 (New), AU103.1.3 (New), SECTION AU104 (New), AU104.1 (New), SECTION AU104 (New), AU104.1 AU105.1 (New), AU104.1.1 (New), AU104.1.2 (New), AU104.1.3 (New), AU104.1.4 (New), SECTION AU106 (New), AU106.1 (New), ANSI Chapter 44 (New), ASTM Chapter 44 (New)

Proponents:

Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com); Ron Olberding, representing Edward Wayne (ronolberding@sbcglobal.net); David Allen, Edward Wayne Inc., representing Edward Wayne (davidallen89@att.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

Appendix U Physical Security

SECTION AU101 General

AU101.1 Purpose. The purpose of this appendix is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

AU101.2 Scope Application. The provisions of this appendix shall apply to all new structures and to additions and alterations made to existing buildings as provided for in Section R102.7.1.

SECTION AU102 DOORS

AU102.1 Doors. All exterior ~~swinging doors of residential dwelling units and attached garages, including and~~ doors leading from the garage area into the dwelling unit, shall comply with Sections AU102.1.1 through AU102.1.5 based on the type of door installed.

Exceptions:

1. Vehicle access doors
2. Storm or screen doors

AU102.1.1 Wood doors. ~~Exterior w~~ Wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) ~~where measured at the locking device or hinge, at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1 inch (25.4 mm) in thickness.~~

AU102.1.2 Steel doors. ~~Exterior s~~ Steel doors shall be a minimum skin thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

AU102.1.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

AU102.1.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the door frame, or by other approved methods.

AU102.1.5 Sliding doors. ~~Exterior s~~ Sliding doors shall be installed to prevent the removal of the panels ~~and the glazing~~ from the exterior.

SECTION AU103 DOOR FRAMES

AU103.1 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. ~~Two-inch nominal wood~~ Horizontal blocking shall be placed horizontally between studs at the door lock height for at least ~~one~~ three stud spaces of equivalent bracing on each side of the door opening. Door frames shall comply with ATSM F476 Grade 40 for the bolt and hinge impact. Door frames shall comply with Sections AU103.1.1 through ~~AU103.1.2~~ AU103.1.3 based on the type of door installed.

AU103.1.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelites lights, shall be reinforced ~~in accordance with ASTM F476 Grade 40.~~

AU103.1.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel ~~and reinforced at the hinges and strikes.~~ Doors ~~are to~~ shall be anchored to the wall in accordance with the manufacturer's instructions.

AU103.1.3 ~~AU105.1.5 Sidelite light entry entries doors.~~ Sidelite light doors units shall have framing of double stud construction or equivalent construction ~~that complies with Sections AU103.1.1 or AU103.1.2.~~ Double stud construction or equivalent construction shall exist between the glazing unit of the side lite light and the wall structure of the dwelling.

SECTION AU104 Door Jambs

AU104.1 Door jambs. Door jambs shall comply with one of the following:

- ~~1. Door jambs constructed as per ASTM F476.~~
- ~~2. Door stops on wooden jambs for in-swinging doors shall be of one-piece construction.~~

SECTION AU104 ~~AU105~~ DOOR HARDWARE

AU104.1 ~~AU105.1~~ Door hardware. Exterior door hardware shall comply with Sections AU104.1.1 ~~AU105.1.1~~ through AU104.1.4 ~~AU105.1.4~~.

AU104.1.1 ~~AU105.1.1~~ Hinges. Hinges for exterior swinging doors shall comply with the following:

- At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure ~~shall be used.~~ Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
- Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

Exception: Sidelite doors complying with ASTM F476 for the bolt and hinge impact test.

AU104.1.2 ~~AU105.1.2~~ Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's edge at the location of the deadbolt interior side.

AU104.1.3 ~~AU105.1.3~~ Locks. Exterior doors shall be provided with a deadbolt with a minimum grade ~~2~~ B as determined by ANSI/BHMA A156.40.

AU104.1.4 ~~AU105.1.4~~ Entry vision and glazing. ~~All main or front~~ Front entry doors to dwelling units shall be arranged so that the occupant has a 180 degree view of the area immediately outside the door without opening the door. ~~The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.~~

SECTION AU106 ~~Alternate Materials and Methods of Construction~~

AU106.1 ~~Alternate materials and methods of construction.~~ The provisions of this appendix are not intended to prevent the use of any material or method of construction not specifically prescribed by this appendix, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this appendix. The materials, method of construction and structural design limitations provided for in this appendix shall be used unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this appendix.

A156.40: American National Standard for Residential Deadbolts

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F476: Standard Test Methods for Security of Swinging Door Assemblies

Commenter's Reason: The changes here reflect concerns and comments expressed from the committee for their decision on RB 161. The committee agreed this language belongs in the Appendix so the items presented in this public comment should address the concerns expressed by the committee members as well as others who spoke in opposition at the committee hearings.

One of the concerns the committee expressed was that this code change goes beyond the minimum requirements of the IRC. Per Section R101.3, the purpose of the IRC is to safeguard the public safety in general as well as for safety to life and property from fire and other hazards attributed to the built environment. How is protecting the occupants of a home from unwanted physical entry not providing a minimum level of protection for the public safety?

Another concern expressed by the committee was that the building code is not a crime prevention code. We agree with the committee. However, the code does address life safety, which is what we believe this code change covers.

One of the committee members expressed concerns about window opening requirements and that someone wanting entry would enter through the window. This code change is not about windows so we're not sure what the committee's concern was regarding windows. The FBI Uniform Crime Report shows that the majority of break-ins occur through an exterior door, which is what this code change is addressing.

Another committee comment was that this language is commentary. This code change includes code language, so we're not sure what the committee meant by that as commentary is generally language defining the code requirements.

In regards to the statement made by the committee about a false sense of security, current construction practices technically give a false sense of security as there are no requirements for any sense of security to a home owner in the current IRC. If someone wants to break into a home, they will find a way to do so. Much like a smoke detector provides the homeowner ample time to respond to a possible fire, this code change is an attempt to provide the homeowner ample time to respond to an attempted break-in.

What helps to prevent crime is witness potential. By delaying the potential entry into a home, the probability of a witness increases. Whether you live in a rural or urban environment, this code change provides the homeowner ample time to respond.

We believe that we have addressed concerns expressed by not only the committee but others who spoke in opposition with the language presented in this public comment.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost to secure a single door ranges from \$40-60 for a single door unit and between \$140-180 for a double sidelite unit.

Public Comment# 1384

RB301-19

IRC: APPENDIX U(New)

Proposed Change as Submitted

Proponents: Deck Code Coalition, Charles Bajnai (chair), North American Deck and Railing Assoc (NADRA), representing Deck Code Coalition (csbajnai@gmail.com)

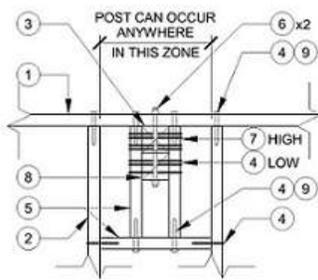
2018 International Residential Code

Add new text as follows:

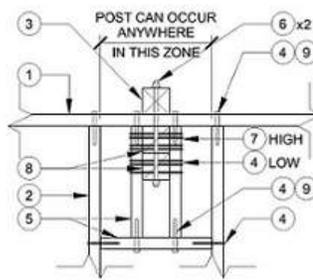
APPENDIX U **DECK GUARD DETAILS**

SECTION AU101 **GENERAL**

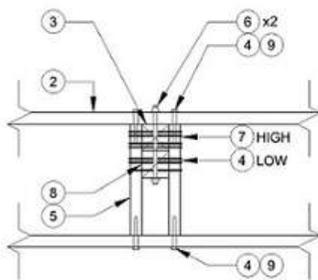
AU101.1 Deck guards. Figures AU101.1(1) and AU101.1(2) are prescriptive options for deck guard, wood post connections to deck framing.



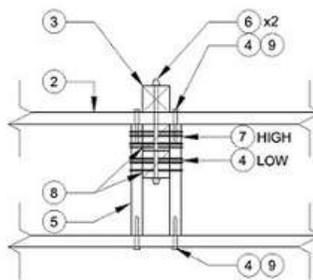
RIM WITH POST INSIDE FRAMING



RIM WITH POST OUTSIDE FRAMING

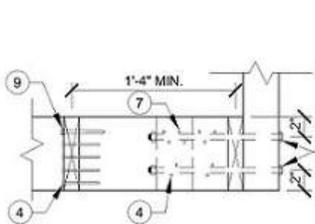


SIDE JOIST WITH POST INSIDE FRAMING

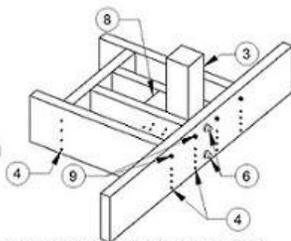


SIDE JOIST WITH POST OUTSIDE FRAMING

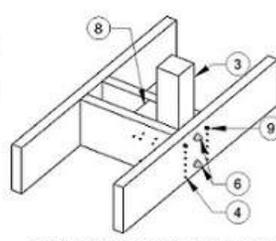
- NOTES:**
1. MIN. 2x8 RIM BOARD OR DECK BEAM
 2. MIN. 2x8 DECK JOIST
 3. MIN. 4x4 GUARD POST, 36" GUARD HEIGHT MAX
 4. 4 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
 5. FULL HEIGHT BLOCKING
 6. 1/2" Ø HOT-DIPPED GALVANIZED BOLTS WITH NUTS AND WASHERS
 7. 7 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
 8. 4x4 BLOCKING FULL DEPTH
 9. 5/16" x 4" GALVANIZED LAG SCREW



ELEVATION: HARDWARE LOCATIONS



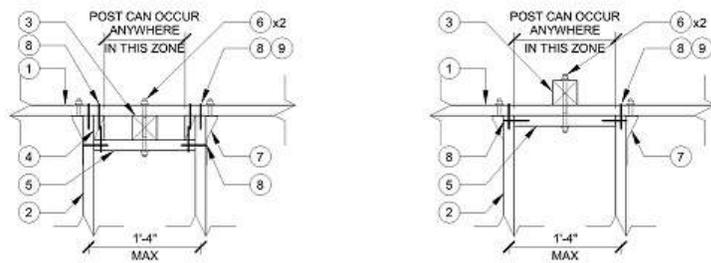
AXON: RIM WITH POST INSIDE FRAMING



AXON: SIDE WITH POST INSIDE FRAMING

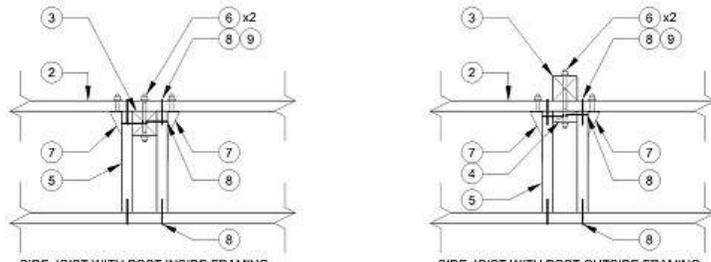
**FIGURE AU1
GUARD POST CONNECTIONS WITH COMMODITY FASTENERS**

**UA101.1(1)
GUARD POST CONNECTION WITH COMMODITY FASTENERS**



RIM WITH POST INSIDE FRAMING

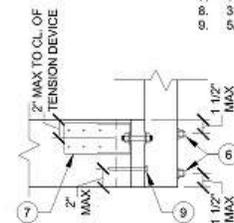
RIM WITH POST OUTSIDE FRAMING



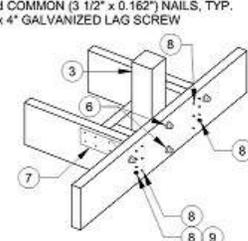
SIDE JOIST WITH POST INSIDE FRAMING

SIDE JOIST WITH POST OUTSIDE FRAMING

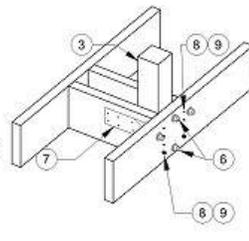
- NOTES:
1. MIN. 2x8 RIM BOARD OR DECK BEAM
 2. MIN. 2x8 DECK JOIST
 3. MIN. 4x4 GUARD POST, 36" GUARD HEIGHT MAX
 4. 2x4 BLOCKING FULL DEPTH
 5. FULL HEIGHT BLOCKING
 6. 1/2" Ø HOT-DIPPED GALVANIZED BOLTS WITH NUTS AND WASHERS
 7. TENSION DEVICE WITH 1800# CAPACITY
 8. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
 9. 5/16" x 4" GALVANIZED LAG SCREW



ELEVATION: HARDWARE LOCATIONS



AXON: RIM WITH POST INSIDE FRAMING



AXON: SIDE WITH POST INSIDE FRAMING

FIGURE AU2
GUARD POST CONNECTIONS WITH TENSION DEVICES

AU2 GUARD POST CONNECTIONS WITH TENSION DEVICE

Reason: The Deck Code Coalition (DCC) proposes a new appendix to offer direction for constructing exterior guards on decks where the code is currently silent.

The members of the DCC recognize that there are many methods for constructing guards, and that the inclusion of a single detail within the body of the code may restrict creativity in the building community. However, there are many people building, specifying, and reviewing decks that are eager for guidance with the complicated connection that is required for connecting deck guard posts to deck framing. Providing a prescriptive detail in an appendix allows us to provide the guidance of an engineered solution that meets the intent of the code.

Homeowners need these details. Empirical evidence shows us that over fifty percent of the decks constructed in the country are built by the homeowners themselves. These details might not be the typical by professional, customized deck builders, but they will be infinitely valuable for the homeowner who has little or no construction knowledge, does not want to pay for design services and will build one deck in his/her lifetime. Without prescriptive details, they will either resort to friends, YouTube or other sources, such as DCA6, for guidance. They say, "just show me how you want it, and I will build it that way".

Building officials need these details. Short of having every deck design tested in a lab or sealed by an engineer, there is not a building official who knows if the guards pass muster. The hip check is not a proper testing method. These details are a minimum engineered design which they can look for if they have no other evidence of code compliance.

Cost Impact: The code change proposal will increase the cost of construction

Two figures are offered. One figure offers generic, cheap fastening techniques of nails and bolts into blocking, the other figure uses proprietary

fasteners for about \$20 per post (around \$140 for a 144 square foot deck using 7 guard posts).

On the other hand, a savings of time and money could be anticipated for the conscientious homeowner who might pay a professional designer to prepare his deck drawings.

Any extra cost has to be weighed against the increased safety and potential life savings that will occur across the country over many years.

RB301-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal is inconsistent. It might be beneficial to reference back to where this is required. Details of each might add clarity. The committee encourages the proponents to bring the proposal back with the correct loading during the public comment period. (Vote: 8-3)

Assembly Action:

None

RB301-19

Individual Consideration Agenda

Public Comment 1:

IRC®: AU101.1 (New), AU101.2 (New), FIGURE UA101.1(1) (New), FIGURE FIGURE AU101.1(2) (New), Add new Figure as follows FIGURE AU101.1(3) (New), FIGURE AU101.1(4) (New), FIGURE AU101.1(5) (New)

Proponents:

Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AU101.1 Deck guards. General. Figures AU101.1(1) and AU101.1(2) through AU101.1(5) are prescriptive options for connecting wood deck guard wood posts connections to wood deck framing.

AU101.2 Load assumptions. Figures AU101.1(1) through AU101.1(5) are engineered to resist a 200 pound point load applied in accordance with Table R301.5 to a single, wood guard post in conformance with Section R507.10.1.

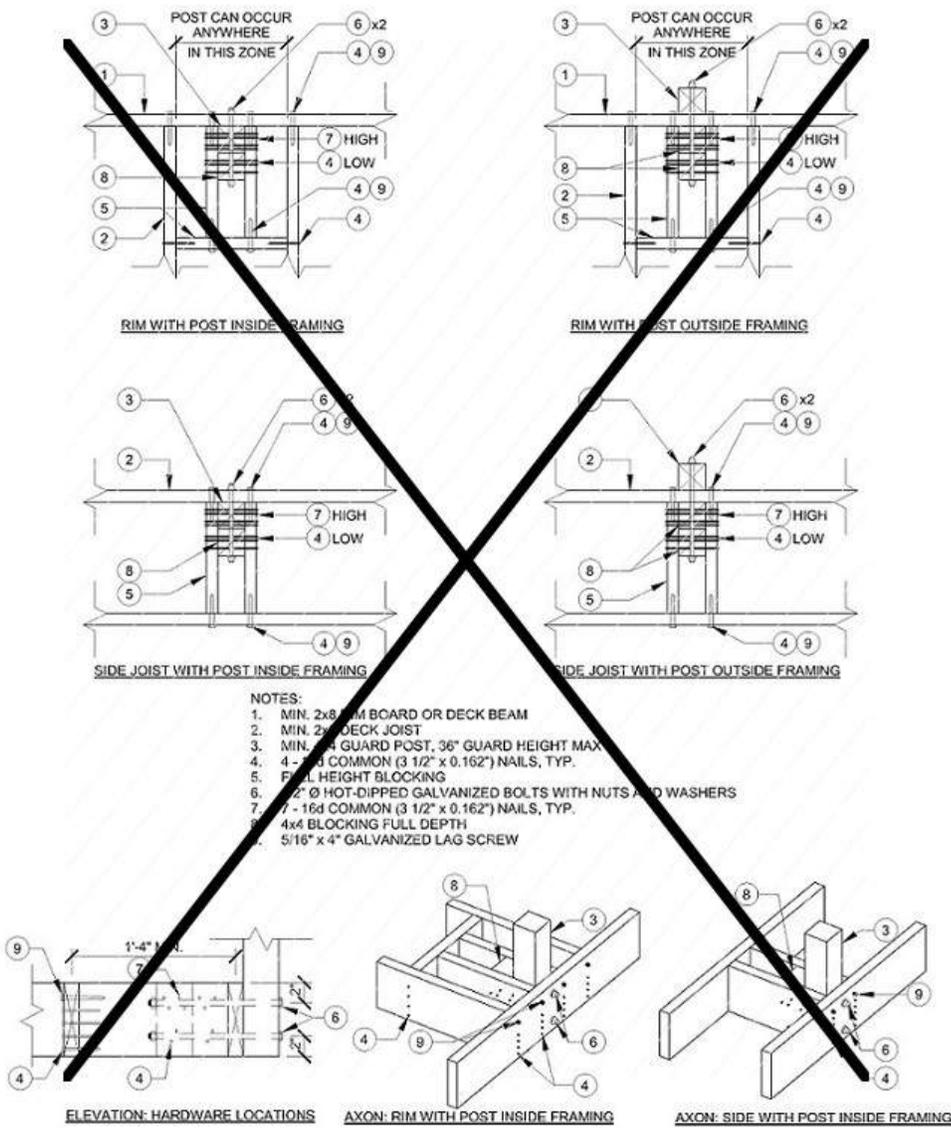
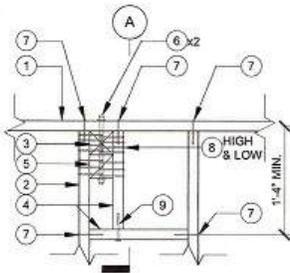
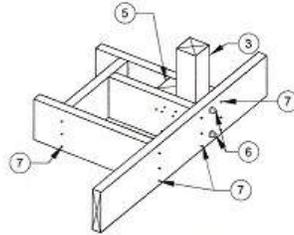


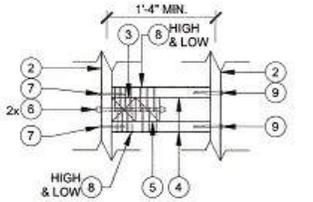
FIGURE AU1
GUARD POST CONNECTIONS WITH COMMODITY FASTENERS



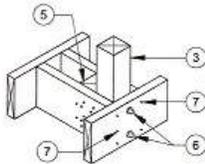
RIM WITH POST INSIDE FRAMING



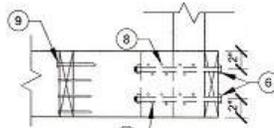
AXON: RIM WITH POST INSIDE FRAMING



SIDE JOIST WITH POST INSIDE FRAMING



AXON: SIDE JOIST WITH POST INSIDE FRAMING



SECTION A

NOTES:

1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. 4x4 BLOCKING FULL DEPTH
6. 1/2" Ø HOT-DIPPED GALVANIZED BOLTS WITH NUTS AND WASHERS
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 7 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW W/ 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.

FIGURE UA101.1(1)
GUARD POST CONNECTION WITH COMMODITY FASTENERS

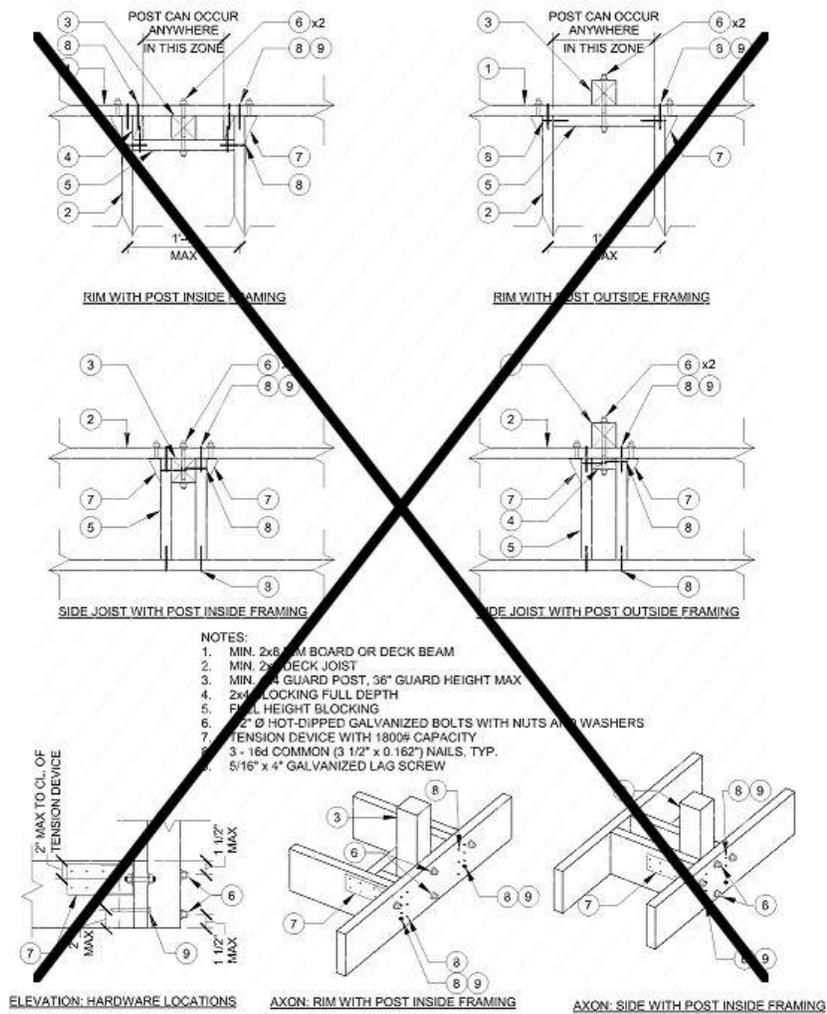
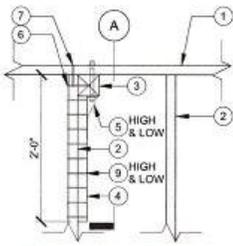
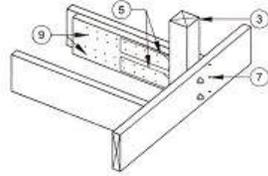


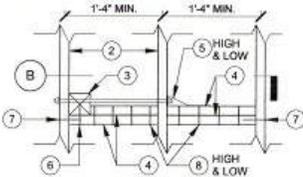
FIGURE AU2
GUARD POST CONNECTIONS WITH TENSION DEVICES



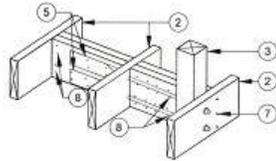
RIM WITH POST INSIDE FRAMING



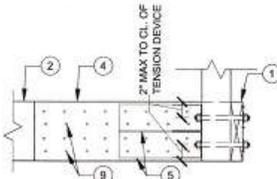
AXON: RIM WITH POST INSIDE FRAMING



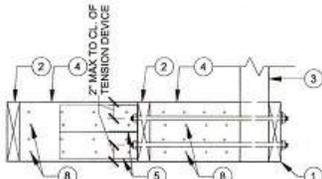
SIDE JOIST WITH POST INSIDE FRAMING



AXON: SIDE JOIST WITH POST INSIDE FRAMING



SECTION A

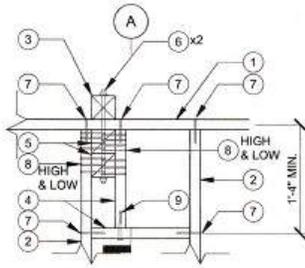


SECTION B

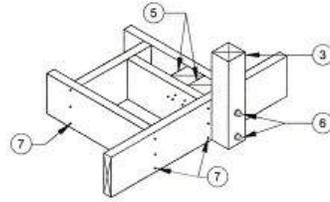
NOTES:

1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. TENSION DEVICE WITH 1800# CAPACITY, FASTENERS NOT SHOWN.
6. 2 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 8 - 10d COMMON (3" x 0.148") NAILS, BLOCKING-TO-BLOCKING TYP.
9. 16 - 10d COMMON (3" x 0.148") NAILS, BLOCKING-TO-JOIST TYP.
10. BOTTOM TENSION DEVICE REQUIRED FOR INWARD LOAD ON GUARD

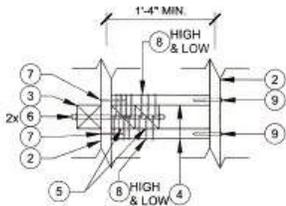
FIGURE AU101.1(2)
GUARD POST CONNECTIONS INSIDE FRAMING WITH TENSION DEVICE



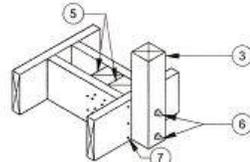
RIM WITH POST OUTSIDE FRAMING



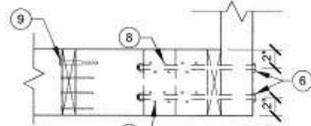
AXON: RIM WITH POST OUTSIDE FRAMING



SIDE JOIST WITH POST OUTSIDE FRAMING



AXON: SIDE JOIST WITH POST OUTSIDE FRAMING

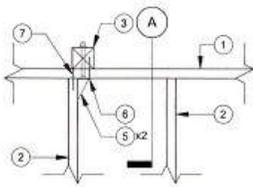


SECTION A

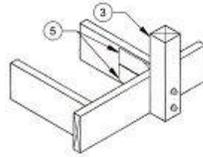
NOTES:

1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. 4x4 BLOCKING FULL DEPTH
6. 1/2" Ø HOT-DIPPED GALVANIZED BOLTS WITH NUTS AND WASHERS
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 7 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW W/ 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.

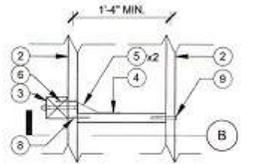
FIGURE AU101.1(3)
GUARD POST CONNECTIONS OUTSIDE FRAMING WITH COMMODITY FASTENERS



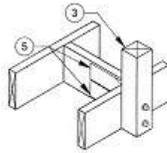
RIM WITH POST OUTSIDE FRAMING



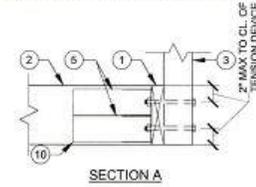
AXON: RIM WITH POST OUTSIDE FRAMING



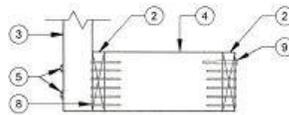
SIDE JOIST WITH POST OUTSIDE FRAMING



AXON: SIDE JOIST WITH POST OUTSIDE FRAMING



SECTION A

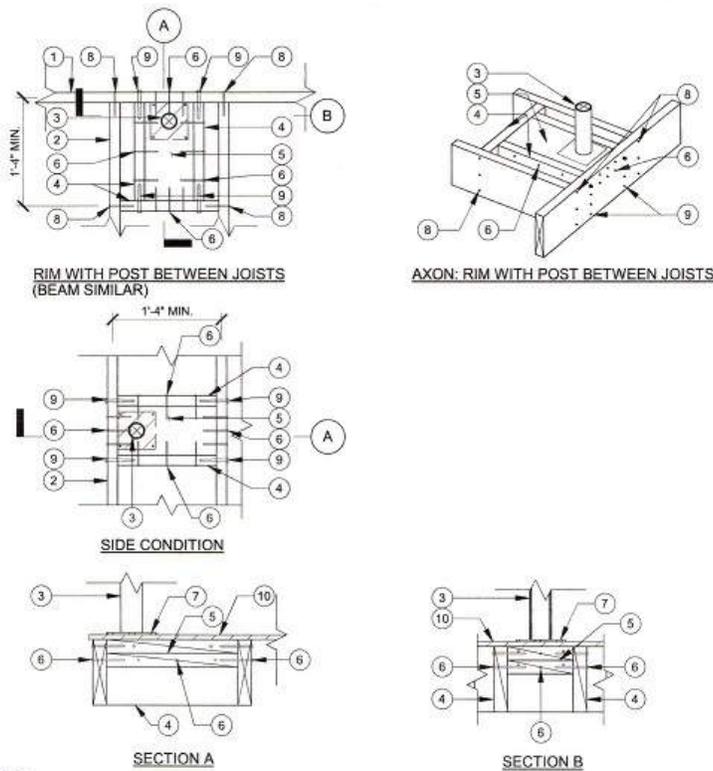


SECTION B

NOTES:

1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. TENSION DEVICE WITH 1800# CAPACITY, FASTENERS NOT SHOWN
6. 2 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 6 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW W/ 5 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
10. BOTTOM TENSION DEVICE REQUIRED FOR INWARD LOAD ON GUARD

FIGURE AU101.1(4)
GUARD POST CONNECTIONS OUTSIDE FRAMING WITH TENSION DEVICES



- NOTES:
1. MIN. 2x8 RIM BOARD OR DECK BEAM
 2. MIN. 2x8 DECK JOIST
 3. TOP MOUNTED GUARD POST INSTALLED PER MANUFACTURER'S INSTRUCTIONS MOUNTED TO DECK FRAMING TYPICAL, 39" MAX HEIGHT
 4. 2x VERTICAL BLOCKING, FULL DEPTH
 5. (2) 2x8 LAID FLAT, INCREASE BLOCKING DEPTH TO ACCOMMODATE FULL EMBEDMENT OF MANUFACTURER'S REQUIRED CONNECTION HARDWARE.
 6. 6 - 16d COMMON (3 1/2" x 0.162") NAILS, THROUGH 1-PLY RIM JOIST OR BLOCKING TYP.
 7. (4) 10d NAILS FOR ATTACHING DECKING TO BLOCKING AT POST CONNECTION.
 8. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
 9. 3/8" x 4" GALVANIZED LAG SCREW AND (3) 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
 10. DECKING MAX THICKNESS 1 1/2"

FIGURE AU101.1(5)
TOP MOUNTED GUARD POST CONNECTIONS WITH COMMODITY FASTENERS

Commenter's Reason: The committee acknowledged that prescriptive options for connecting wood guards to wood decks was needed by building officials and contractors across the country. They encouraged the Deck Code Coalition to revise the details to be in compliance with Table R301.5. The DCC listened to the committee and opposition testimony and engineered five new prescriptive options that meet the loading requirements in the approved code change RB85-19 for 200# in the four primary loading directions: up, down, in and out:

AU101.1(1) Posts attached to deck framing (interior of rim/beam) with commodity fasteners, i.e. nails

AU101.1(2) Posts attached to deck framing (interior of rim/beam) with tension fasteners

AU101.1(3) Posts attached to deck framing (exterior of rim/beam) with commodity fasteners

AU101.1(4) Posts attached to deck framing (exterior of rim/beam) with tension fasteners

AU101.1(5) Posts attached to the top of decking

This public comment intends to:

1. State that the details are optional and in compliance with Table R301.5
2. Are intended for wood guard posts and wood decks, and not intended for other materials.

3. And that the loading assumptions are based on the applied load bearing on a single post - not load-shared with other posts and/or connectors.
4. Include top mounted posts.

The Deck Code Coalition has worked extremely hard over these past few years to promote deck safety, provide easy to understand code language for the D-I-Y homeowner, and these prescriptive details satisfy these needs. We encourage to support this appendix so municipalities and jurisdictions across the country can use them.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
See cost statement in the original code change proposal.

Public Comment# 1670

RB302-19

IRC@: Appendix U (New), SECTION U101 (New), U101 (New), U102.1 (New), SECTION U103 (New), U103.1 (New), U103.2 (New), U103.3 (New), U103.4 (New), U103.5 (New), SECTION U104 (New), U104.1 (New), U104.2 (New), U104.3 (New), U104.4 (New), SECTION U105 (New), U105.1 (New), SECTION U106 (New), (New)

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL LLC, representing UL LLC (jonathan.roberts@ul.com)

2018 International Residential Code

Add new text as follows:

Appendix U **3D PRINTED BUILDING CONSTRUCTION**

SECTION U101 **General**

U101 Scope. Buildings and structures fabricated in whole or in part using 3D printed construction techniques shall be designed, constructed and inspected in accordance with the provisions contained in this Appendix and other applicable requirements in this code.

U102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

3D PRINTED BUILDING CONSTRUCTION. A process for fabricating buildings and structures from 3D model data using automated equipment that deposits construction material in a layer upon layer fashion.

ADDITIVE MANUFACTURING MATERIALS. Materials used by the 3D printer to produce the building structure or system components of the building.

PRODUCTION EQUIPMENT. The equipment, including 3D printer, its settings, nozzles and other accessories used in the fabrication process.

FABRICATION PROCESS. Preparation of the job site and construction material, and the deposition, curing, finishing, insertion of components and other methods used to build building elements such as walls, partitions, roof assemblies and structural components, and the means used to connect assemblies together.

SYSTEM COMPONENTS. Devices, equipment and appliances that are installed in the building elements as part of the wiring, plumbing, HVAC and other systems. These include, but are not limited to, electrical outlet boxes, conduit, wiring, piping, tubing, and HVAC ducts, each of which is covered by a product standard or Installation Code Requirement.

SECTION U103 **Building Design**

U103.1 Design organization. 3D printed buildings and structures shall be designed by an organization certified in accordance with UL 3401 by an approved agency and approved by the building official based on this section.

U103.2 Engineered design. The plans included in the UL 3401 compliance report shall be used for determining compliance with the engineering design requirements in Section R301.1.3 of this code.

U103.3 Performance design. The requirements in Chapters 4 through 9 and Chapter 11 of this code shall be waived where the UL 3401 compliance report demonstrates that the 3D printed construction provides an equivalent level of performance as the prescriptive code requirements.

U103.4 Other Equipment and Systems. Where not covered by the UL 3401 compliance report, the following provisions of this code shall be used as a basis for determining compliance for the following equipment and systems:

1. Chimneys and fireplaces – Part III, Chapter 10.
2. Energy efficiency – Part IV.
3. Mechanical – Part V.
4. Fuel gas – Part VI.
5. Plumbing – Part VII.
6. Electrical – Part VIII.

U103.5 Ratings The building or structure ratings in the UL 3401 compliance report, including but not limited to fire-resistance, interior finish, roofing

fire classification, insulation material R-value shall be suitable for the installation. The acceptability of material and system ratings not included in the compliance report shall be determined by the building official.

SECTION U104 BUILDING CONSTRUCTION

U104.1 Construction. 3D printed buildings and structures shall be constructed in accordance with this section.

U104.2 Construction method. The building construction method, consisting of the manufacturer's *production equipment and fabrication process* shall be in accordance with the UL 3401 compliance report. The unique identifier of the construction method used shall match the identifier in the UL 3401 compliance report.

U104.3 Additive manufacturing materials. Only the listed additive manufacturing materials identified in the UL 3401 compliance report shall be used to fabricate the building structure or system components. Containers of the additive manufacturing materials shall be labeled.

U104.4 Depositing of manufacturing materials. Manufacturing materials shall only be deposited where ambient temperature and environmental conditions at the job site are within limits specified in the UL 3401 compliance report. The maximum number of layers permitted, specified curing time and any surface preparation or finishing shall be performed as specified in the UL 3401 compliance report.

SECTION U105 Special Inspections

U105.1 Initial inspection An initial inspection of the production equipment, including 3D printer, and the fabrication process shall be performed after the production equipment is located onsite and before building fabrication has begun. The inspection shall be conducted by representatives of the organization that evaluated the fabrication process for compliance with UL 3401. The inspection shall verify that the fabrications process, including production equipment, 3D printing parameters and construction materials are in accordance with the UL 3401 compliance report, and proprietary information in the UL 3401 detailed report of findings.

Exception: Where approved by the building official, inspections of the production equipment, including 3D printer, and the fabrication process used in a single housing tract shall be conducted on the first building to be constructed, and on a selected number of subsequent buildings, where the same equipment, equipment operators and fabrication process are used on all buildings. The number of inspections to be performed shall be determined by the building official.

SECTION U106 REFERENCED STANDARDS

UL 3401-19 Outline of Investigation for 3D Printed Building Construction

Reason: 3D building construction has moved from a conceptual stage to reality, and projects are being proposed in an increasing number of jurisdictions. Unfortunately the prescriptive design and construction requirements in the IRC are not applicable to 3D printed fabrication techniques, so code officials have to approve this construction based on limited equivalency evaluations that may not take into account variations in material properties introduced by the 3D printing process, or variances in the physical characteristics of the construction materials used. The UL 3401 Outline of Investigation for 3D Printed Building Construction was developed to evaluate critical aspects of this construction process, and level the playing field so that 3D printed building techniques comply with an equivalent level of safety and performance as legacy construction techniques currently in the code.

This proposal introduces an Appendix U, which is not mandatory unless specifically referenced in an adopting ordinance. The Appendix includes definitions, and requirements for 3D printed building design, construction and special inspections, which rely on the design being evaluated in advance by an approved agency for compliance with UL 3401. The resulting compliance report includes the information needed by the contractor and code official to verify compliance with applicable code requirements, and to verify that the 3D printing process and materials used on site are the same as those used during the UL 3401 evaluation and testing. The special inspection requirements are necessary because the portions of the fabrication process such as 3D printer settings, deposition rates and thickness, and curing processes, require special expertise to evaluate, especially when they include proprietary formulations, equipment and settings.

A companion proposal introduces revisions to R301.1.1 that also references UL 3401 and 3D printed building construction. These two proposals will work together, but each also stands on its own.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal will not increase the cost of construction because it covers a construction technique that is not currently addressed in the code.

Staff Analysis: A review of the standard proposed for inclusion in the code, UL 3401-19, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: There are no technical requirements in this code section. This seems to be a process or a means and method of construction. There are a number of references to the approval of the building official. The special inspection section needs to be tightened up. The system should have a peer review. This type of construction is akin to manufactured housing and similar issues to those in the manufactured housing appendix should be addressed. These provisions rely heavily on UL 3401 and the compliance report and take approval out of the hands of the code official. (Vote: 9-1)

Assembly Action:

None

RB302-19

Individual Consideration Agenda

Public Comment 1:

IRC@: Appendix U (New), SECTION U101 (New), U101 (New), SECTION U102 (New), U102.1 (New), SECTION U103 (New), U103.1 (New), U103.2 (New), U103.3 (New), U103.4 (New), U103.5 (New), SECTION U104 (New), U104.1 (New), U104.2 (New), U104.3 (New), U104.4 (New), SECTION U105 (New), U105.1 (New)

Proponents:

Howard Hopper, representing UL LLC (howard.d.hopper@ul.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

Appendix U 3D PRINTED BUILDING CONSTRUCTION

SECTION U101 General

U101 Scope. Buildings, ~~structures and building elements and structures~~ fabricated in whole or in part using 3D printed construction techniques shall be designed, constructed and inspected in accordance with the provisions contained in this Appendix and other applicable requirements in this code.

SECTION U102 Definitions

U102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

3D PRINTED BUILDING CONSTRUCTION. A process for fabricating buildings, ~~structures and building elements and structures~~ from 3D model data using automated equipment that deposits construction material in a layer upon layer fashion.

FABRICATION PROCESS. Preparation of the job site and construction material, and the deposition, curing, finishing, insertion of components and other methods used to ~~construct build~~ building elements such as walls, partitions, roof assemblies and structural components, and the means used to connect assemblies together

<Other definitions unchanged>

SECTION U103 Building Design

U103.1 Design organization. 3D printed buildings, ~~structures and building elements and structures~~ shall be designed by an organization certified in accordance with UL 3401 by an approved agency and approved by the building official ~~in accordance with~~ based on this section.

U103.2 Design approval ~~Engineered design.~~ The plans included in the ~~structural design, construction documents, and UL 3401 compliance report~~ report of findings shall be submitted for review and approval in accordance with Section 104.11 of this code. ~~shall be used for determining compliance with the engineered design requirements in Section R301.1.3 of the International Residential Code.~~

U103.3 Performance design. The requirements in Chapters 4 through 9 and Chapter 11 of this code shall be waived where the UL 3401 compliance report demonstrates that the 3D printed construction provides an equivalent level of performance as the prescriptive code requirements.

U103.4 Other Equipment and Systems. Where not covered by the UL 3401 compliance report, the following provisions of this code shall be used as a basis for determining compliance for the following equipment and systems:

1. Chimneys and fireplaces — Part III, Chapter 10.
2. Energy efficiency — Part IV.
3. Mechanical — Part V.
4. Fuel gas — Part VI.
5. Plumbing — Part VII.
6. Electrical — Part VIII.

U103.5 Ratings The building or structure ratings in the UL 3401 compliance report, including but not limited to fire resistance, interior finish, roofing fire classification, insulation material R-value shall be suitable for the installation. The acceptability of material and system ratings not included in the compliance report shall be determined by the building official.

SECTION U104 BUILDING CONSTRUCTION

U104.1 Construction. 3D printed buildings, ~~structures, and building elements and structures~~ shall be constructed in accordance with this section.

U104.2 Construction method. The building construction method, consisting of the manufacturer's *production equipment* and *fabrication process* shall be in accordance with the UL 3401 ~~compliance report~~ report of findings. The unique identifier of the construction method used shall match the identifier in the UL 3401 ~~compliance report~~ report of findings.

U104.3 Additive manufacturing materials. Only the listed *additive manufacturing materials* identified in the UL 3401 ~~compliance report~~ report of findings shall be used to fabricate the building structure or system components. Containers of the additive manufacturing materials shall be labeled.

U104.4 Depositing of manufacturing materials. Manufacturing materials shall only be deposited where ambient temperature and environmental conditions at the job site are within limits specified in the UL 3401 ~~compliance report~~ report of findings. The maximum number of layers permitted, specified curing time and any surface preparation or finishing shall be performed as specified in the UL 3401 ~~compliance report~~ report of findings.

SECTION U105 Special Inspections

U105.1 Initial inspection An initial inspection of the *production equipment*, including 3D printer, and the *fabrication process* shall be performed after the *production equipment* is located onsite and before building fabrication has begun. The inspection shall be conducted by representatives of the ~~approved agency organization~~ that evaluated the *fabrication process* for compliance with UL 3401. The inspection shall verify that the ~~fabrications process~~, including *production equipment*, 3D printing parameters and ~~construction~~ additive manufacturing materials are in accordance with the UL 3401 ~~compliance report~~ report of findings, and ~~the~~ proprietary information in the UL 3401 detailed report of findings.

Exception: Where approved by the building official, inspections of the *production equipment*, including 3D printer, and the *fabrication process* used in a single housing tract shall be conducted on the first building to be constructed, and on a selected number of subsequent buildings, where the same equipment, equipment operators and *fabrication process* are used on all buildings. The number of inspections to be performed shall be determined by the building official.

Commenter's Reason: The original proposal has been revised to address concerns raises prior to and at the committee action hearings. Items to consider:

1. At the CAH hearings six people testified in support and no one testified against the proposal.
2. The IRC currently requires 3D printed buildings and building elements to be evaluated using alternate materials and methods requirements, with no additional guidance to follow. This appendix provides additional technical information that designers and local building officials can use to justify equivalency.
3. There was concern that the UL 3401 report of findings superseded the building official approval process. This is not the case, the UL 3401 report provides technical information on the 3D printing process, fabrication methods and materials used, ratings achieved for code mandated tests, and other construction details. Together with the structural design and construction documents this provides a solid technical foundation for the building official to use to evaluate the 3D printed building construction under the alternate materials and methods requirements in Section 104.11.
4. The public comment clarifies the documents to be provided to the building official to approve the 3D printed construction, which include the structural design, construction documents, and UL 3401 report of findings. It also deleted unnecessary prescriptive requirements originally in

Sections U103.3 through U103.5.

5. A question was raised about the qualifications of the special inspector. Testimony from the floor indicated there are no specific qualification for special inspectors in the I-codes, and IBC Section 1704.1 requires special inspections to be performed by an approved agency. This proposal requires the UL 3401 evaluation to performed by an approved agency (U101.1), and the special inspector to be a representative of this approved agency (U105.1)
6. There was a comparison of the 3D printed construction to factory built housing. To clarify, this Appendix covers homes constructed (3D printed) at the installation site.
7. A comment was made about the building official not being able to require a peer review of the project design documents. This is not the case, the jurisdiction can still require a peer review under existing code provisions.
8. Bottom line, this comment provides a methodology and technical information that building officials can use to approve 3D printed buildings, structures and building elements under the IRC equivalency requirements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal covers a construction technique that is not currently addressed in the code.

Public Comment# 1602

GG1-19

IGCC®: SECTION 101, 101.1, 101.2 (2.3), 101.2.2 (1.2), 101.3 (New), 101.3.1 (2.1), 101.3.1 (2.2), 101.4 (1.1), 101.5

Proposed Change as Submitted

Proponents: David Collins, representing SEHPCAC (SEHPCAC@iccsafe.org)

2018 International Green Construction Code

SECTION 101 GENERAL

101.1 Title. These regulations shall be known as the Green Construction Code of [NAME OF JURISDICTION] hereinafter referred to as “this code.”

Revise as follows:

~~101.3.3-101.2 (2.3)~~ **General.** This code is intended to provide minimum requirements to be used in conjunction with the other codes and standards adopted by the jurisdiction. The requirements in this code shall not be used to circumvent any applicable safety, health, or environmental requirements.

Delete without substitution:

~~101.2.2 (1.2)~~ This code is intended to provide the technical basis of mandatory building codes and regulations for *high-performance green buildings* that are broadly adoptable by national and local jurisdictions.

Add new text as follows:

101.3 Scope. The provisions of this code shall apply to the design, construction, addition, alteration, change of occupancy, relocation, replacement, equipment, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures and to the building site on which the building is located. Occupancy classifications shall be determined in accordance with the *International Building Code*.

Delete without substitution:

~~101.3.1 (2.1)~~ This code contains requirements that address site sustainability, water use efficiency, energy efficiency, indoor environmental quality (IEQ), materials and resources, and construction and plans for operation. This code applies only to the following *building projects*:

- ~~1. New buildings and their systems.~~
- ~~2. New portions of buildings and their systems.~~
- ~~3. New systems and equipment in existing buildings.~~
- ~~4. Relocated existing buildings and temporary structures where specified in this code.~~

Revise as follows:

~~101.3.2-101.3.1 (2.2)~~ The provisions of this code do not apply to the following:

1. Single-family dwellings.
2. Multifamily dwellings of three stories or fewer above grade.
3. Manufactured houses (mobile homes).
4. Manufactured houses (modular).
5. *Building projects* that use none of the following:
 1. Electricity.
 2. Fossil fuels.
 3. Water.

~~(Informative note Exception:~~ The provisions in Appendix J for residential and multifamily construction apply where adopted by the authority having jurisdiction.) jurisdiction.

~~101.2.1-101.4 (1.1)~~ **Intent.** The purpose-intent of this code is to provide minimum requirements for the siting, design, construction, and plans for operation of *high-performance green buildings* to: reduce emissions from buildings and building systems; enhance building occupant health and comfort; conserve water resources; protect local biodiversity and ecosystem services; promote sustainable and regenerative materials cycles; enhance building quality; enhance resilience to natural, technological, and human-caused hazards; and support the goal of development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

~~101.4.1(4.1)~~ **101.5 General Compliance.** *Building projects* shall comply with this code. ~~Within each of Chapters 5 through 11. Within each of these chapters 11,~~ *building projects* shall comply with all mandatory provisions (x.3) and, where offered, either the:

1. Prescriptive Option (x.4) or
2. Performance Option (x.5).

Reason: This proposal correlates the standard ICC Chapter 1 language with the administration language contained in ASHRAE Standard 189.1. New Section 101.2 (General) is a standard ICC section. In the 2018 IgCC it was covered, in essence, by Sections 101.2.2 and 101.3.3.

New Section 101.3 (Scope) is standard ICC scoping language.

2018 IgCC Section 101.3.2 is renumbered (no change to text) as Section 101.3.1 and is retained as a list of what are essentially exceptions to the scope.

2018 IgCC Sections 101.2.1 and 101.3.1 (Purpose and Scope) are now more appropriately combined and retitled as Section 101.4, Intent.

"Informative Notes" are typical in ASHRAE standards; in this proposal the informative note is clearly indicated as what it actually is: an exception.

The provisions of 2018 IgCC Sections 101.2 and 101.2.1 (Purpose) and 101.3.1 (Scope) are more appropriately relocated and retitled as Section 101.3, Intent.

The title of new Section 101.5 has been changed from "Application/General" to "Compliance" to differentiate it from the Section 102, Applicability.

This proposal is submitted by the ICC Sustainability, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors in July of 2011 to pursue opportunities to improve and enhance the IECC, the IgCC and the energy provisions of the IRC. The SEHPCAC held 4 open meetings in 2018. In addition, there were numerous Working Group meetings and conferece calls for the current code development cycle, which included members of the committee as well as interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the SEHPCAC website at: <https://www.iccsafe.org-tech-support/codes/code-development-process/sustainability-energy-and-high-performance-code-action-committee-sehpcac>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal reorganizes and clarifies the code. It does not create any technical changes that would affect construction costs.

GG1-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

101.3.1 (2.2) The provisions of this code do not apply to the following:

1. Single-family dwellings.
2. Multifamily dwellings of three stories or fewer above grade.
3. Manufactured houses (mobile homes).
4. Manufactured houses (modular).
5. *Building projects* that use none of the following:
 1. 5.1. Electricity.
 2. 5.2. Fossil fuels.
 3. 5.3. Water.

~~**Exception:** The provisions in Appendix J for residential and multifamily construction apply where adopted by the authority having jurisdiction.~~

Committee Reason: This proposal does not, and is not intended to, make technical changes what so ever to the technical content as developed by ASHRAE. It is intended to cleanup the administrative language that was merged together from previous versions of the IgCC and ASHRAE 189.1, which have their own administration provisions. As noted in testimony, this is intended to bring the IgCC in line with other provisions of the I-codes and keep them correlated.

Modification reason: The committee approved GG4 which provides pointers to Appendix H and Appendix J. This modification eliminates duplication and confusion and is an appropriate modification.

(Vote: 5-0)

Assembly Action:

None

GG1-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved for the following reasons:

-The language is completely different from the scope of ASHRAE Standard 189.1, 2017 version.

-The language will likely be completely different from the scope of the 2020 version of ASHRAE Standard 189.1.

-The language states that it applies to "every building", while the current IGCC scope and Standard 189.1 state that it only applies to high-performance green buildings.

-This scope mentions demolition, where the 189.1 scope does not.

-The 189.1 scope mentions sustainability, water efficiency, energy efficiency, indoor environmental quality, and materials where this scope does not.

-Under the ASHRAE continuous maintenance process, all parts of the Standard, including the title, purpose and scope, are subject to change at any time, from any interested party. If someone is successful in changing the purpose and/or scope in 189.1 within the next year, but the language is different from this scope, and his/her successful change does not appear in the IGCC, that could be grounds for appeal under the ANSI process.

Disapproving this revision will prevent any such conflicts.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will not change the current code language.

Public Comment# 1254

GG3-19

IGCC@: 101.4.1(4.1), Table 101.4.1 (New)

Proposed Change as Submitted

Proponents: David Collins, representing SEHPCAC (SEHPCAC@iccsafe.org)

2018 International Green Construction Code

Revise as follows:

101.4.1(4.1) General. *Building projects* shall comply with Chapters 5 through ~~4+~~ 11. Within each of these chapters, *building projects* shall comply with all mandatory provisions (x.3) and, where offered, either the:

1. Prescriptive Option (x.4) or
2. Performance Option (x.5).

Exceptions:

1.Compliance shall not be required with Sections that are listed in Table 101.4.1 where the jurisdiction has opted out by checking "No" in the corresponding cell in the jurisdictional requirement column.

2.Where the jurisdiction has indicated a diversion percentage for Section 5.3.8.1 in Table 101.4.1, that percentage shall replace the diversion percentage indicated in Section 5.3.8.1.

Add new text as follows:

**Table 101.4.1
REQUIREMENTS DETERMINED BY THE JURISDICTION**

Section	Section Title	Jurisdictional Requirement
Chapter 5 - Site Sustainability		
5.3.3.2	Greenfield Sites	No
5.3.5.2	Mitigation of Heat Island Effect - Walls	No
5.3.6	Reduction of Light Pollution	No
5.3.7.1.1.1	Public Frontage Walkway	No
5.3.7.1.2	Bicycle Paths	No
5.3.7.2	Bicycle Parking	No
5.3.7.3	Preferred Parking	No
5.3.8.1	Building Site Waste Management - Diversion Percentage	90%
		75%
		50%
Chapter 6 - Water Use Efficiency		
6.3.1.2	Irrigation	No
6.3.3	Special Water Heater Features	No
6.3.4.2	Consumption Data Collection	No
6.3.4.3	Data Storage and Retrieval	No
6.3.8	Dual Water Supply Plumbing	No
Chapter 7 - Energy Efficiency		
7.3.4	Automated Demand Response	No
7.4.2.1	Building Envelope Requirements	No
7.4.2.2	Single Rafter Roof Insulation	No
7.4.2.3	High Speed Doors	No
7.4.2.4	Air Curtains	No
7.4.2.6	Permanent Projections	No
7.4.2.9	Orientation	No
7.4.3.2	Ventilation Controls for Densely Occupied Spaces	No
7.4.3.4	Economizers	No
7.4.3.5	Zone Controls	No
7.4.3.6	Fan System Power and Efficiency	No
7.4.3.7	Exhaust Air Energy Recovery	No
7.4.3.8	Kitchen Exhaust Systems	No
7.4.3.10	Automatic Control of HVAC and lights in Hotel/Motel Guest Rooms	No
7.4.4.2	Insulation for Spa Pools	No
7.4.6.2	Occupancy Sensor Controls with Multilevel Switching or Dimming	No
7.4.6.3	Automatic Controls for Egress and Security Lighting	No
7.4.6.4	Controls for Exterior Sign Lighting	No
7.4.6.5	Parking and Outdoor Sales Lighting	No
7.4.7.2	Supermarket Heat Recovery	No
7.4.7.3.1	ENERGY STAR Requirements for Equipment not Covered by Federal Appliance Efficiency Regulations (All Building Projects)	No
7.4.7.4	Programmable Thermostats	No
7.4.7.5	Refrigerated Display Cases	No

Chapter 8 - Indoor Environmental Quality		
8.3.1.3.(b)	Ozone	No
8.3.1.4	Building Pressure	No
8.3.1.5.1	Vented Combustion	No
8.3.1.9	Guest Room Preoccupancy Outdoor Air Purge Cycle	No
8.3.1.10	Preoccupancy Ventilation Control	No
8.3.2	Thermal Environmental Conditions for Human Occupancy	No
8.3.3.4	Interior Sound Reverberation	No
8.4.1.3	Shading for Offices	No
Chapter 9 - Materials and Resources		
9.3.1.3	Construction Waste	No
Chapter 10 - Construction and Plans for Operation		
10.3.1.5.b	IAQ Construction management (Flush-out)	No
10.3.1.8	Construction Activity Pollution Prevention: Protection of Occupied Areas	No
10.3.1.9	Soil-Gas Control	No
10.3.2.1.1	Site Sustainability	No
10.3.2.1.2.2	Track and Access Water Use	No
10.3.2.1.2.3	Documentation of Water Use	No
10.3.2.1.3	Energy Efficiency	No
10.3.2.1.4	IAQ	No
10.3.2.4.2	Transportation Management Plan, Owner Occupied Building Projects or Portions of Building Projects	No
10.3.2.4.3	Transportation Management Plan, Building Tenant	No

Reason: This proposal is intended to increase adoptions of the IgCC by allowing jurisdictions to customize the code so that it may be more acceptable to more of the parties affected. The proposal generally simplifies the code for owners, designers, manufacturers, code officials and elected officials by identifying provisions that may not be suitable in all locations and allowing jurisdictions to opt out of them. All other code sections are considered to be core requirements, suitable for all jurisdictions and critically important in order to be considered a green or sustainable building. The user of Chapter 7 is required to comply with ASHRAE 90.1-2016 which saves more energy than the requirements that many jurisdictions now require. Many of the requirements listed in Table 101.4 for Chapter 7 are beyond those in ASHRAE 90.1 for the same topic.

This proposal is submitted by the ICC Sustainability, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance the IECC, the IgCC and the energy provisions of the IRC. The SEHPCAC held 4 open meetings in 2018. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the SEHPCAC website at: <https://www.iccsafe.org-tech-support/codes/code-development-process/sustainability-energy-and-high-performance-code-action-committee-sehpcac>.

Cost Impact: The code change proposal will decrease the cost of construction where jurisdictions opt-out of requiring compliance with code sections, construction costs decrease.

GG3-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

Section	Section Title	Jurisdictional Requirement
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Chapter 5 - Site Sustainability		
5.3.3.2	Greenfield Sites	<input type="checkbox"/> No
5.3.5.2	Mitigation of Heat Island Effect - Walls	<input type="checkbox"/> No
5.3.6	Reduction of Light Pollution	<input type="checkbox"/> No
5.3.7.1.1.1	Public Frontage Walkway	<input type="checkbox"/> No
5.3.7.1.2	Bicycle Paths	<input type="checkbox"/> No
5.3.7.2 5.3.7.2.2	Bicycle Parking Location	<input type="checkbox"/> No
5.3.7.3 5.3.7.2.3	<u>Preferred Bicycle Parking, Horizontal Parking Racks</u>	<input type="checkbox"/> No
5.3.7.2.5	<u>Bicycle Parking, Security and Visibility</u>	<input type="checkbox"/> No
5.3.8.1	Building Site Waste Management - Diversion Percentage	<input type="checkbox"/> 90% <input type="checkbox"/> 75% <input type="checkbox"/> 50%
Chapter 6 - Water Use Efficiency		
6.3.1.2 6.3.1.2.1 a3	Irrigation System Design, Master Valve	<input type="checkbox"/> No
6.3.1.2.1 a4	<u>Irrigation System Design, Flow Sensors</u>	<input type="checkbox"/> No
6.3.3	Special Water Heater Features	<input type="checkbox"/> No
6.3.4.2	Consumption Data Collection	<input type="checkbox"/> No
6.3.4.3	Data Storage and Retrieval	<input type="checkbox"/> No
6.3.8	Dual Water Supply Plumbing	<input type="checkbox"/> No
Chapter 7 - Energy Efficiency		
7.3.4	Automated Demand Response	<input type="checkbox"/> No
7.4.2.1	Building Envelope Requirements	<input type="checkbox"/> No
7.4.2.2	Single Rafter Roof Insulation	<input type="checkbox"/> No
7.4.2.3	High Speed Doors	<input type="checkbox"/> No
7.4.2.4	Air Curtains	<input type="checkbox"/> No
7.4.2.6	Permanent Projections	<input type="checkbox"/> No
7.4.2.9	Orientation	<input type="checkbox"/> No
7.4.3.2	Ventilation Controls for Densely Occupied Spaces	<input type="checkbox"/> No
7.4.3.4	Economizers	<input type="checkbox"/> No
7.4.3.5	Zone Controls	<input type="checkbox"/> No
7.4.3.6	Fan System Power and Efficiency	<input type="checkbox"/> No
7.4.3.7	Exhaust Air Energy Recovery	<input type="checkbox"/> No
7.4.3.8	Kitchen Exhaust Systems	<input type="checkbox"/> No
7.4.3.10	Automatic Control of HVAC and lights in Hotel/Motel Guest Rooms	<input type="checkbox"/> No
7.4.4.2	Insulation for Spa Pools	<input type="checkbox"/> No
7.4.6.2	Occupancy Sensor Controls with Multilevel Switching or Dimming	<input type="checkbox"/> No
7.4.6.3	Automatic Controls for Egress and Security Lighting	<input type="checkbox"/> No
7.4.6.4	Controls for Exterior Sign Lighting	<input type="checkbox"/> No
7.4.6.5	Parking and Outdoor Sales Lighting	<input type="checkbox"/> No
7.4.7.2	Supermarket Heat Recovery	<input type="checkbox"/> No
7.4.7.3.1	ENERGY STAR Requirements for Equipment not Covered by Federal Appliance Efficiency Regulations (All Building Projects)	<input type="checkbox"/> No
7.4.7.4	Programmable Thermostats	<input type="checkbox"/> No
7.4.7.5	Refrigerated Display Cases	<input type="checkbox"/> No

Chapter 8 - Indoor Environmental Quality		
8.3.1.3.(b)	Ozone	<u> </u> No
8.3.1.4	Building Pressure	<u> </u> No
8.3.1.5.1	Vented Combustion	<u> </u> No
8.3.1.9	Guest Room Preoccupancy Outdoor Air Purge Cycle	<u> </u> No
8.3.1.10	Preoccupancy Ventilation Control	
8.3.2	Thermal Environmental Conditions for Human Occupancy	<u> </u> No
8.3.3.4	Interior Sound Reverberation	<u> </u> No
<u>8.3.4</u>	<u>Soil Gas Control</u>	<u> </u> No
8.4.1.3	Shading for Offices	<u> </u> No
Chapter 9 - Materials and Resources		
9.3.1.3 <u>9.3.1.2</u>	Construction <u>Total Waste</u>	<u> </u> No
Chapter 10 - Construction and Plans for Operation		
10.3.1.5.b	IAQ Construction management (Flush-out)	<u> </u> No
10.3.1.8	Construction Activity Pollution Prevention: Protection of Occupied Areas	<u> </u> No
10.3.1.9	Soil-Gas Control	<u> </u> No
10.3.2.1.1	Site Sustainability	<u> </u> No
10.3.2.1.2.2	Track and Access Water Use	<u> </u> No
10.3.2.1.2.3	Documentation of Water Use	<u> </u> No
10.3.2.1.3	Energy Efficiency	<u> </u> No
10.3.2.1.4	IAQ	<u> </u> No
<u>10.3.2.3</u>	<u>Service Life Plan</u>	<u> </u> No
10.3.2.4.2	Transportation Management Plan, Owner Occupied Building Projects or Portions of Building Projects	<u> </u> No
10.3.2.4.3	Transportation Management Plan, Building Tenant	<u> </u> No

Committee Reason: Scottsdale, Arizona has relied on similar lists contained in the 2012 and 2015 IgCC to customize the code for their specific needs. The list does not tamper with the technical requirements of ASHRAE Standard 189.1. As indicated in testimony, other jurisdictions such as those in Colorado and Washington D.C. have also found such lists beneficial in their adoption to customize the code for their specific needs. The Building Codes Assistance Project advocates for the IgCC and has found that most jurisdictions that have adopted the IgCC have used such lists of options. Such options can save years in the adoption process.

This list of options will make the IgCC more adoptable.

The modification updates the list of jurisdictional requirement options to coincide with the most recent efforts of the ASHRAE Standard 189.1 committee in the development of a similar list. There will likely be further updates in the Public Comment period.

(Vote: 5-0)

Assembly Action:

None

GG3-19

Individual Consideration Agenda

Public Comment 1:

IGCC@: Table 101.4.1 (New)

Proponents:

Greg Johnson, representing ICC Sustainability, Energy, and High Performance Code Action Committee (SEHPCAC)
(gjohnsonconsulting@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Green Construction Code

**Table 101.4.1
REQUIREMENTS DETERMINED BY THE JURISDICTION**

Portions of table not shown remain unchanged.

6.3.3	Special Water Heater Features	<input type="checkbox"/> No
7.4.3.6	Fan System Power and Efficiency	<input type="checkbox"/> No
7.4.3.10	Automatic Control of HVAC and lights in Hotel/Motel Guest Rooms	<input type="checkbox"/> No
8.3.1.4.2	Building Pressure Exfiltration	<input type="checkbox"/> No
8.3.1.5.1	Vented Combustion	<input type="checkbox"/> No
8.3.1.9	Guest Room Preoccupancy Outdoor Air Purge Cycle	<input type="checkbox"/> No
8.3.1.10	Preoccupancy Ventilation Control	
8.3.4	Soil Gas Control	<input type="checkbox"/> No
10.3.1.5.b	IAQ Construction management (Flush-out)	<input type="checkbox"/> No
10.3.1.9	Soil Gas Control	<input type="checkbox"/> No
10.3.2.1.2.2	Track and Access	<input type="checkbox"/> No
10.3.2.1.2.3	Documentation of Water Use	<input type="checkbox"/> No
10.3.2.1.3	Energy Efficiency	<input type="checkbox"/> No
10.3.2.1.4	IAQ	<input type="checkbox"/> No

Commenter's Reason: These changes are necessary to correlate the 2021 IgCC with the base document, ASHRAE Standard 189.1 -2020. These proposed modifications align with the most current requirements published by the ASHRAE 189.1 committee under its continuous maintenance process.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. These are administrative provisions related to adoption and subject to local determination. The impact on construction costs is impossible to assess.

Public Comment# 2038

Public Comment 2:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved for the following reasons:

-Under the ASHRAE 189.1 process, these tables are considered to be technical content. Revisions to these tables are currently being made through the ASHRAE process/procedures and will be going out for public review.

-It is very likely that this table will be different than the tables that are finalized for the 2020 version of ASHRAE Standard 189.1, especially if changes are made after the current IGCC process has been completed by November, 2019.

-Under the ASHRAE continuous maintenance process, all parts of the Standard, including the core / non-core requirements, are subject to change at any time, from any interested party. If someone is successful in changing one or more jurisdictional options (core / non-core) in 189.1 within the next year, but the language is different from this table, and his/her successful change does not appear in the IGCC, that could be grounds for appeal under the ANSI process. If a 2nd person is successful in changing the provision in the IGCC through the ICC process, but it does not appear in Standard 189.1, that could also be grounds for appeal.

Disapproving this proposal revision will prevent any such conflicts.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will not change the language in the current code.

Public Comment# 1260

RE2-19

IECC: R103.2.2 (IRC N1101.5.2) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

R103.2.1 (IRC N1101.5.1) Building thermal envelope depiction. The *building thermal envelope* shall be represented on the construction documents.

Add new text as follows:

R103.2.2 (IRC N1101.5.2) Vapor management declaration. A vapor management strategy shall be documented on the construction documents. The following shall be addressed:

1. Type and class of vapor retarder used throughout the building, or listed per assembly, to manage moisture migration via diffusion as required by Section R402.1.1.
2. Vapor retarder installation scope of work to ensure proper installation.
3. Whole house ventilation strategy to be used in accordance with Section R403.6 and Section M1505.3 of the *International Residential Code* to ensure background ventilation moisture control.
4. Spot/local exhaust ventilation strategy to be used in accordance with Section M1505.4.4 of the *International Residential Code* to manage/remove moisture as it is created
5. Flashing and weather resistant barrier type and installation details.

Reason: Currently the IRC allows one of three vapor retarder strategies to be used in a residential dwelling unit all of which require different levels of installation execution and coordination with the rest of the structure and systems that are built and the energy code features that are required by the IECC. In addition, the three strategies only address diffusion which is one of two means of moisture transport that is occurring in a dwelling unit. Moisture moves in a house by diffusion (which the vapor retarder addresses) but also with air. How we expect to control these two moisture transport mechanisms should be made prominent on the plan set to create more efficient and durable structures. This is especially true since more moisture flows into building assemblies through air transport than by the process of diffusion. This code change proposal promotes a subtle shift in our thinking to understand that moisture management is a combination of components and systems working together to protect the building from moisture related failures.

In the prescriptive section R402.1.1 Vapor retarders are required to be installed and the section refers you to the IRC and the IBC. Vapor Retarders discussed in these sections are an important part of gaining control and predictability of the moisture movement within a dwelling unit, but there is a choice that must be made as to which class of retarder will be installed. The installation of class 1 versus class 3 vapor retarder is significantly different and impacts the efficiency and durability of the structure differently.

This declaration will drive moisture management considerations into the design process resulting in assemblies that will be more moisture resistant and more efficient.

The scope of work requirement will better ensure that especially class 1 vapor retarders are installed to limit the ability of air and moisture from bypassing them and being trapped within assemblies. It should also create a better understanding of where a class 1 vapor retarder should or should not be installed in different climate zones. For example, in climate zone 5 along the front range in Colorado we often see unsealed class 1 vapor retarders (6 mil poly) installed behind drywall on exterior walls, but no vapor retarder installed in other parts of the exterior wall assembly such as rim joist or exterior walls in bathrooms. This declaration would elevate the inconsistency of placement of vapor retarders as their installation would be more clearly thought out on the plan set than it has ever been in the past.

Whole house and spot/local ventilation are another important part of the moisture management strategy. From a whole house ventilation perspective,

the code gives three choices of strategies that can be used, some of which work better in certain climate zones than others. The vapor management declaration, would bring the decision on systems that will be installed to the fore front for review by the plans examiner allowing for conversation prior to building the structure.

Cost Impact: The code change proposal will increase the cost of construction

There would be a small cost increase associated with this proposal as the proposal merely brings existing requirements together to be reported on the plan set. I estimate that this would require no more than 1 hour of time of the designer or architect. Approximately \$100 - \$200.

RE2-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee found that the language of the proposal was unclear. The case for a 'declaration' was not made, it should simply be adequate to put the information on the plans. The declaration would impose additional costs and potential liability on architects. (Vote: 9-2).

Assembly Action:

None

RE2-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R103.2 (IRC N1101.5), R103.2.1 (IRC N1101.5.1), R103.2.2 (IRC N1101.5.2) (New)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

R103.2.1 (IRC N1101.5.1) Building thermal envelope depiction. The *building thermal envelope* shall be represented on the construction documents.

R103.2.2 (IRC N1101.5.2) Vapor management declaration. A vapor management strategy shall be documented on the construction documents. The following shall be addressed:

1. Type and class of vapor retarder used throughout the building, or listed per assembly, to manage moisture migration via diffusion as required by Section R402.1.1.
2. ~~Vapor retarder installation scope of work to ensure proper installation.~~
3. Whole house ventilation strategy to be used in accordance with Section R403.6 and Section M1505.3 of the *International Residential Code* to

ensure background ventilation moisture control.

4. ~~Spot/local exhaust ventilation strategy to be used in accordance with Section M1505.4.4 of the *International Residential Code* to manage/remove moisture as it is created~~
5. ~~Flashing and weather resistant barrier type and installation details.~~

Commenter's Reason: Although it is adequate to put vapor retarder information on the plan set as suggested by the committee, there is no requirement to declare which of the three vapor management strategies will be used or to include them on the plan set in the IRC or the IECC. The interaction of the IECC requirements and the vapor management strategy chosen is critical to coordinate, and this proposal ensures that thought is put into it. The language and the requirements were simplified to address the committee's concerns about clarity. The requirement is not to simply declare which of the three vapor retarders and which of the three ventilation strategies will be used. The requirement ensures the code official knows upfront what to look for, and the design professional considers the interaction of energy and vapor management.

I agree with the committee that this increases the cost to generate the plan set by a small amount and clearly stated that in the original cost statement which I continue to stand by. With regards to liability, this declaration should reduce liability as it specifically declares which strategies must be used, and if they are not carried out, the design professional can clearly point to what was specified.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

There would be a small cost increase associated with this proposal as the proposal merely brings existing requirements together to be reported on the plan set. I estimate that this would require no more than 1 hour of time of the designer or architect. Approximately \$100 - \$200.

Public Comment# 1767

RE7-19

IECC: R202 (IRC N1101.6), R404.1 (IRC N1104.1)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Revise as follows:

HIGH-EFFICACY LAMPS. LIGHT SOURCES. Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an efficacy of not less than ~~the following: 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt.~~

1. ~~60 lumens per watt for lamps over 40 watts.~~
2. ~~50 lumens per watt for lamps over 15 watts to 40 watts.~~
3. ~~40 lumens per watt for lamps 15 watts or less.~~

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures shall contain only ~~high-efficacy lamps.~~lighting sources.

Reason: The lighting section includes a requirement for a minimum percentage of "high efficiency lamps." However, the definition of "high efficacy lamps" has not been updated to reflect the changes in the market due to increased federal minimums and greater availability/affordability of LED lighting. Because of this, the code is actually becoming less stringent as the baseline for lighting equipment is raised. The proposal solves this problem by updating the definitions with lighting requirements that reflect what is actually "high-efficacy" in today's market. The proposal also simplifies the definition by reducing the number of wattage categories. The categories in the residential code are an artifact of incandescent and early compact fluorescent lamp wattages. As lamps have gotten more efficient, the higher wattage categories have become less meaningful. As lamps have gotten more efficient, the higher wattage categories have become less meaningful. Even a "100W equivalent" LED lamp and "60W equivalent" CFL lamps generally uses 15W or less, which is the lower category in the existing definition. As a result, the categories have become largely meaningless.

The proposal also accommodates high efficacy luminaires. Many luminaires on the market do not include lamps and include integrated LEDs instead. The way the current code language is written, these efficient lighting products cannot be used to meet the lighting efficiency requirements in the code. The proposal changes the term in the definition to be more inclusive, adds an efficacy requirement for integrated luminaires, and updates the code language to reflect this update.

Cost Impact: The code change proposal will increase the cost of construction. This change could potentially increase the cost of construction because it requires higher efficacy lighting (lamps and/or fixtures), which will likely eliminate some lower-end CFL options and/or push builders to newer LED technologies. However, the cost of LEDs has been steadily declining over the last several years and is expected to continue to decline. Based on an analysis by the U.S. Department of Energy's Building Energy Codes Program conducted during the 2018 IECC Code Development cycle, the estimated and projected prices for LEDs were \$4.84 per lamp compared to CFLs at \$3.10 per lamp. However, the rapid expansion of the LED lighting market has changed the economics. A spot check of Home Depot in early 2019 showed that a warm white, 60W equivalent A-lamp is as low as \$1.24 for both CFL and LED when purchased in packs. And, LEDs are actually cheaper than CFLs at some sources. At 1000bulbs.com, an online retailer, the same lamps are \$1.79/bulb for CFL and \$0.99 for LED. Therefore, this code change may actually reduce the cost of construction.

RE7-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Great change that will save energy. Brings the code up the standards of lighting manufacturers. (Vote: 11-0)

Individual Consideration Agenda

Public Comment 1:

IECC@: R404.1 (IRC N1104.1)

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only *high-efficacy lighting sources*.

Commenter's Reason: Because there is no definition for "permanently installed", lamps serving kitchen appliances like range hoods or ovens could be considered "permanently installed" and thereby required to meet the high-efficacy requirements of this section. Achieving high-efficacy in lamps serving appliances like range hoods and ovens is very difficult based on elevated environmental temperatures that diminish useful life. In fact, none of the lamps listed in California's appliance efficiency database are known to be tested or approved for use in range hoods or ovens that can be exposed to air temperature exceeding 100 degrees Celsius, much less the 130-260 degrees Celsius that range hoods and ovens are likely to experience on an occasional basis. The most obvious potential consequence of specifying range hood or oven lamps that are not designed for high temperatures is a severe limitation to lamp life, resulting in large costs for consumers who will need to replace lamps at shorter intervals. Even more importantly, there could be safety concerns with lamp failure in high temperature environments.

Further, the 10% allowance for lamps that are not high-efficacy is not sufficient to exempt kitchen appliance lamps in small dwelling units that have less than 20 lamps (meaning the 2 oven and range hood lamps will account for more than 10% of the total lamps in the dwelling unit). For reasons such as these, California's Title 24 exempts range hood lamps from its high-efficacy lamp requirements (Title 24-2019 Section 150.0(k)1F), and the IECC-C Committee approved two floor modifications to proposals in Albuquerque (CE226-19-Moore7 and CE162-19-Moore3) introducing an exception to high-efficacy lamp requirements in the commercial energy code for kitchen appliance lamps. Approval of RE7 as modified by this public comment will provide reasonable exceptions to the high-efficacy lamp requirement, improve enforcement, and align the IECC-R with action taken in the IECC-C.

For reference, following are floor modifications approved by the IECC-C committee in Albuquerque that provide exceptions to the high-efficacy lamp requirements of the commercial energy code.

CE226-19-Moore7:

C406.3.3 Lamp efficacy. Not less than 95 percent of the interior lighting power (watts) from lamps in permanently installed light fixtures, excluding kitchen appliance light fixtures, in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 65 lumens per watt.

CE162-19-Moore3:

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting, excluding kitchen appliance lighting, serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.4 and C405.3.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment slightly reduces the original proposal potential for cost increase by removing kitchen appliance lighting from the high efficacy requirements. The prices of high efficacy lamps are falling rapidly and as stated by the proponent, the potential for a cost increase could be substantially diminished or eliminated, especially by the time this code is adopted.

Public Comment 2:

IECC@: 202, R404.1 (IRC N1104.1)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

HIGH-EFFICACY LIGHT SOURCES. Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an initial efficacy of not less than ~~65~~ 61 lumens per watt, or luminaires with an initial efficacy of not less than ~~45~~ 50 lumens per watt.

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures shall contain only *high-efficacy ~~lighting~~ light sources.*

Commenter's Reason: These proposed changes improve the proposal, as they are based on the most recent Energy Star specifications for lamps and luminaires.

-By aligning with the Energy Star values, it will help with compliance and enforcement.

-For the Energy Star ratings, the minimum lamp efficiency (efficacy rating) is based on their initial light output, not their mean output.

-For lamps, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of lamp (omnidirectional, directional, or decorative) and their Color Rendering Index (CRI) values (≥ 90 CRI or < 90 CRI). The minimum required initial values range from 61 lumens/Watt to 80 lumens/Watt. Changing the value from 65 to 61 will help align with the latest Energy Star specifications.

-For luminaires, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of fixture (e.g., cove, downlight, accent, outdoor, etc.). The minimum required initial values range from 50 lumens/Watt to 70 lumens/Watt. Changing the value from 45 to 50 will help align with the latest Energy Star specifications and increase efficiency.

-There is also an editorial change ("lighting" to "light") to match the wording of the revised definition.

Bibliography: ENERGY STAR Lamps Final Specification Version 2.1, June 20, 2017, Table 9.1, available at <https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V2.1%20Final%20Specification.pdf>
ENERGY STAR Luminaires Final Specification Version 2.1, March 15, 2018, Table 9.2, available at <https://www.energystar.gov/sites/default/files/Luminaires%20V2.1%20Spec%20Final%20with%20Partner%20Commitments.pdf>

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Lamps and luminaires that have higher efficacies are usually more expensive than standard lamps and luminaires.

Public Comment# 1366

RE10-19

IECC: R202 (IRC N1101.6) (New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

SAMPLING. A process where fewer than 100 percent of a builder's dwellings, dwelling units, or sleeping units are randomly inspected and or tested to evaluate compliance with the requirements of this code.

Reason: This definition is to clarify that the practice of sampling includes more than just blower door testing. The approved third party would have the opportunity to sample any requirement of the code in a development or building. This is a concept that needs to be made apparent to everyone who uses the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
new definition

RE10-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Sampling already is addressed in the code but the term is not defined. This addresses that need. The definition isn't a requirement unto itself and does not authorize sampling in any specific location not already addressed by code language. (Vote: 8-3)

Assembly Action:

None

RE10-19

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION R202 (IRC N1101.6), 202 (New)

Proponents:

Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

SAMPLING. A process where fewer than 100 percent of a builder's all dwellings or dwelling units, or sleeping- being constructed units are randomly inspected and or tested to demonstrate evaluate compliance. ~~with the requirements of this code.~~

Commenter's Reason: The committee approved a definition for sampling which is needed but all references to sampling were also removed from

the IECC at the committee action hearing. Therefore, the importance of the definition becomes even more important. The approved batch sampling definition is problematic because it is defining a process of evaluating compliance in sleeping units instead of dwelling units. In addition, although fewer than 100% of the dwellings or dwelling units are inspected or tested the work is not random. There is a defined and systematic process. Lastly, the definition states that the process is evaluating compliance when in reality the process is demonstrating compliance. The new definition solves these problems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment is a clarification of a definition, Clarifications of code text do not impact the cost of construction.

Public Comment# 1630

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because all homes should be verified as compliant with the code requirements (including tests for air tightness and duct leakage, among others). Sampling a limited number of homes cannot verify compliance with code requirements for homes that are not tested or checked. Although some common voluntary efficiency programs permit sampling for certain specified measures, unlike the code, these programs do not establish the minimum requirements that all homes must meet. For the owner of an untested home that does not comply, it does them no good that the sampled home complied. If the jurisdiction issues a certificate of occupancy, the purchaser of a new home should be entitled to rely on the new home meeting the code.

The proponent claims that with this change, "the approved third party would have the opportunity to sample any requirement of the code in a development or building." By contrast, the Committee claims that this is only a definition and "the definition isn't a requirement unto itself and does not authorize sampling in any specific location not already addressed by code language." We are concerned that some may adopt the proponent's view instead of the Committee's view – and we fear that this new definition would spark a broad expansion of the potential use of sampling, which will be detrimental to ensuring that each building meets the minimum code requirements.

Even if some limited sampling were acceptable, another problem with the proposal is the failure to establish any specifics for sampling. Fewer than 100% implies that anywhere between 1 and 99 out of 100 homes could be checked. Further, there is no process established for when a sampled home does not comply in some respect. In short, under this provision and the proponent's rationale, sampling could be used to check one home for code compliance and give the rest of the homes in the development (or dwelling units in a building) a free pass.

To our knowledge, the only reference to sampling in the residential IECC is a single sentence (with no specifics) that limits any sampling to "stacked multiple family units." (Section R405.4.2) It should be noted that this is a limiting provision, not an authorization to use sampling for compliance. We do not interpret this language already in the code to permit sampling. Nonetheless, we have also proposed to eliminate this language in another proposed code change – RE157 – to reduce confusion. Moreover, all other proposals during this cycle to allow sampling under the residential provisions of the IECC were all properly rejected by the Committee.

If the definition does not by itself permit sampling, then adding the definition is unnecessary and could be confusing. In addition, we are concerned that including a definition of sampling in the IECC per this code proposal could imply that sampling is acceptable and could put code officials in the position of having to explain why sampling is not allowed by the code for specific requirements.

Based on the above, we recommend that this proposal be disapproved along with any others that permit or imply "sampling" as a means for demonstrating code compliance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1451

RE14-19

R303.2 (IRC N1101.11)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

R303.2 (IRC N1101.11) Installation. Materials, systems and equipment shall be installed in accordance with the ~~manufacturer's instructions~~ Grade I insulation installation requirements in RESNET/ICC 301 and the International Building Code or the International Residential Code, as applicable.

Reason: The quality of insulation installation has a significant impact on the performance of the building envelope. When insulation is not properly installed, the code does not achieve the energy savings intended by its insulation requirements. Poorly installed insulation can compromise home performance, resulting in higher energy bills for the builder's customers and increased customer call backs due to comfort issues. Based on a report by Energy Star Certified Homes, Version 3 (Rev. 08) there is a 5% savings for heating and cooling system consumption on properly installed insulation (Grade I) vs Grade II insulation that includes more gaps, voids and compressions.

The current IECC language requires that insulation be installed to manufacturer's instructions. This provision is difficult to enforce because installation instructions will vary based on manufacturer and type of installation (e.g. fiberglass batts versus blown fiber glass versus cellulose). Field inspectors normally don't have ready access to manufacturer's installation instructors when conducting an insulation inspection. Manufacturers require that their product be installed with minimal gaps, voids and compression which relates to Grade I Insulation installation but based on the U.S. DOE field study conducted in several states, less than 50% of the homes had insulation installed to Grade I insulation quality.

To address this issue, RESNET has created a new insulation installation standard that includes requirements for Grade I insulation installation for different types of insulation (e.g. fiberglass batts, blown fiber glass and cellulose). The standards language is included in latest version of RESNET/ICC Standard 301. The Grade I installation requirement will help standardize how insulation should be installed and can be used as a reference by both the insulation contractor and the building department reducing potential issues in the field over how products should be installed. This can also be used by the builder focused on quality assurance as they will know how the insulation product is require to be installed.

Grade I insulation allows very small gaps in the insulation. Voids are not allowed to extend from the interior to the exterior (i.e. the full width of a wall cavity). The product is required to be installed according to manufacturer's specification and cut to fit around electrical junction boxes and is split around wires and pipes. Compression or incomplete fill can amount to 2% or less, if the empty spaces are less than 30% of the intended fill thickness.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There is no cost increase in this code change as the code currently requires insulation to be installed to manufacturers installation instruction which is consistent with Grade I insulation installation requirements.

RE14-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on previous action regarding RE57-19. (Vote: 11-0)

Assembly Action:

None

RE14-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R303.2 (IRC N1101.11)

Proponents:

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R303.2 (IRC N1101.11) Installation. Materials, systems and equipment shall be installed in accordance with the manufacturer's instructions. ~~Grade I insulation installation requirements in RESNET/ICC 301~~ and the International Building Code or the International Residential Code, as applicable. Insulation shall meet the Grade I insulation installation requirements in RESNET/ICC 301.

Commenter's Reason: The quality of insulation installation has a significant impact on the performance of the building envelope. When insulation is not properly installed, the code does not achieve the energy savings intended by its insulation requirements. Poorly installed insulation can compromise home performance, resulting in higher energy bills for the builder's customers and increased customer call backs due to comfort issues. Based on a report by Energy Star Certified Homes, Version 3 (Rev. 08) there is a 5% savings for heating and cooling system consumption on properly installed insulation (Grade I) vs Grade II insulation that includes more gaps, voids and compressions.

To address this issue, RESNET has created a new insulation installation standard that includes requirements for Grade I insulation installation for different types of insulation (e.g. fiberglass batts, blown fiber glass and cellulose). The standards language is included in latest version of RESNET/ICC Standard 301. The Grade I installation requirement will help standardize how insulation should be installed and can be used as a reference by both the insulation contractor and the building department reducing potential issues in the field over how products should be installed. This can also be used by the builder focused on quality assurance as they will know how the insulation product is require to be installed.

The Northwest Energy Codes Group requested disapproval for this proposal based on opponents testimony for RE57 that would have placed the requirement for Grade I insulation in Chapter 4 while keeping the requirement for insulation installation to manufacturers installation instructions in Chapter 3. If passed RE57 would have created a conflict between the chapters. RE14 places the requirement for Grade I insulation Chapter 3 and eliminates any conflict between Chapter 3 and Chapter 4. The opponents brought up several points that are addressed below:

Creating a Potential Conflict between Designating Grade I and Manufacturers Specification

Chapter 3 of the IECC provides oversight language to Chapter 4 and 5 so referencing Grade I in Chapter 3 will apply to Chapter 4 and 5 insulation installation requirements eliminating potential conflicts.

The requirements in Standard 301 are consistent with the insulation installation requirements in the IECC. For example:

- Section A-1.2 (1) Minimum Specific Application Requirements for floor insulation is consistent with the language in IECC Section R402.2.8 Floors.
- Section A-1.2 (3) requires an effective air barrier for ventilated attic insulation and allows the use of eave baffles to meet this requirement. Eave baffles are required in IECC Section R402.2.3.
- Section A-1.3.1 Insulated sheathing requires that the joints are staggered on the sheathing if multiple layers are used. This is consistent with IECC Section C402.2.1.

Length of Grade I Insulation Requirements in RESNET Standard 301 is too long making it difficult to use

One issue that was presented by an opponent to the Grade I insulation installation requirements is that the standard was too long. Standard 301 currently has requirements for the installation of:

- - Insulated Sheathing
- - Fibrous Batt Insulation
- - Blown of Sprayed Fibrous Loose Fill Insulation
- - Open-Cell Spray Polyurethane Foam Insulation
- - Closed-Cell Spray Polyurethane Foam Insulation
- - Structural Insulated Panels
- - Reflective/Radiant Grading Criteria

The 11 page Standard is necessary to cover the installation requirements for the various options listed above. Each section of the document provides requirements on how to install the insulation and then how to Grade the insulation to ensure that achieves Grade I.

The Grade I Insulation Installation requirements reference Standards within the Standard

One argument against referencing the Grade I installation requirements was that the Standard referenced other Standards which was deemed to make Grade I requirements hard to use. Referencing standards within standards is typically done as it would be duplicative to include the text from an entire reference standard if the referenced standard is available. For example NFRC 100 (referenced for determining fenestration U-factors) includes the reference to six different standards and an additional nine different support documents. Standard E779 – Standard Method for Determining Air Leakage Rate by Fan Pressurization includes the reference to three ASTM Standards. E779 is referenced in the commercial provisions of the IECC for air barrier testing. ANSI/RESNET/ICC Standard 380 – 2016 for testing duct and envelope leakage includes references to three standards.

The Grade I Installation requirements uses the term Recommend

ANSI/RESNET/ICC Standard 380 uses the term recommend in six different sections and this standard was reviewed and passed the ICC Standards review process (need name of the process).

The term Recommends is also used in manufactured installation instructions. For example the CertainTeed CertaWrap Weather Resistant Barrier & Accessories Installation Guidelines uses the terms Recommends and Recommend. Using the term "recommends, recommendation or

recommended" in the standard is consistent with the manufacturers installation instructions.

The Grade I Installation requirements is difficult to enforce

The current IECC language requires that insulation be installed to manufacturer's instructions. This provision is difficult to enforce because installation instructions will vary based on manufacturer and type of installation (e.g. fiberglass batts verses blown fiberglass verses cellulose). Field inspectors normally don't have readily accessible manufacturer's installation instructions when conducting an insulation inspection. Manufacturers require that their product be installed with minimal gaps, voids and compression which relates to Grade I Insulation installation but based on the U.S. DOE field study conducted in several states, less than 50% of the homes had insulation installed to Grade I insulation quality.

Enforcement checklists can easily be developed using the Grade I requirements as can industry training programs. Adopting this requirement will provide the necessary standardized instructions on how to install insulation that can be used for the building and enforcement industry resulting in an increase in enforcement. Enforcement agencies will have a standardized set of instructions that can be used for inspection that will result in increased quality of installations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

There is no cost increase in this code change as the code currently requires insulation to be installed to manufacturers installation instruction which is consistent with Grade I insulation installation requirements.

Public Comment# 1872

Public Comment 2:

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests Disapprove

Commenter's Reason: As the committee stated on RE57 and noted again on RE14, RESNET's new appendix on grade 1 insulation is not ready. Installing insulation correctly is important, but the significantly changed grade 1 insulation requirements will do more harm than good. A partial list of the problems with RESNET's 301 grade 1 appendix follows. In all cases the problems cite examples of specific text from the new RESNET 301 Grade 1. Most of the problems fall into one of these groups:

-eliminates reasonable construction techniques and/or products

-mixes up "recommendations" and "instructions"

-has incomplete or unusable references as requirements

Bold below is added. All section titles and numbers are from RESNET's new 301 appendix. "Comments" below briefly state the problem.

Eliminates reasonable construction techniques or products:

*A-1.1 Minimum General Installation Requirements ... PART 2 - **No air spaces** shall be allowed between different insulation types or systems.* - Comment - Sometimes **air spaces are needed** for drainage and moisture redistribution. For example foil faced insulation over spray foamed wall cavity without an air space would be a problem. Stucco rot and some EIFS problems are partly a result of a lack of air spaces.

A-1.2 Minimum Specific Application Requirements 1. ...The combination of both cavity and continuous insulation shall meet or exceed the minimum required floor R value in Table 402.1.2 of the International Energy Conservation Code, (IECC).... - Comment - RESNET's criteria says floor insulation cannot be Grade 1 unless the R-value meets or exceeds 2018 IECC Table 402.1.2? Why? Why just the floors? RESNET is mixing up R-value with quality of the installation.

*3. ... The effective air barrier shall extend up and beyond the surface of the insulation **or to the ridge vent.*** - Comment - This is a problem for cathedral ceilings. Baffles are not air barriers.

*A-2.2 Structural Insulated Panels (SIPs) Grading Criteria ... 2. **Use spray foam to seal** penetrations through the SIP panels. ... 4. All gaps and penetrations through SIPs including windows, doors, and foundation or roof connections shall be **air-sealed with expanding foam** compatible with the SIP materials.* - Comment - Why only expanding foam for air sealing? What about mastics, tapes and caulking?

*A-2.3.2 Attic Radiant Barriers Minimum Requirements ... 3. Attic and/or roof **ventilation shall be maintained.** Roof, gable and soffit vents shall not be covered.* - Comment - What about unvented attics? Does this eliminate unvented attics in the IRC?

Comment- RESNET exempts fiberglass in basement and crawl spaces from air barriers if there is an interior air barrier (Appendix Section A1.3.2, #2

item “d”). This fiberglass exemption is fine. However, cellulose should also have the exemption as cellulose is denser than fiberglass and cellulose would do an even better job of inhibiting convection within the insulation.

Mixes up "recommendations" and "instructions":

*A-1.1 Minimum General Installation Requirements PART 1 - Insulation shall be installed to manufacturers' **recommendations**.* - Comment - code uses "instructions". "Instructions" and "recommendations" can be very different. Can insulation be grade 1 without following the manufacturer's instructions? Manufacturers and the code expect instructions to be followed. The code does not require or even refer to manufacturer's recommendations. From the IRC: "Section R302. Installation. Materials, systems and equipment shall be installed in accordance with the **manufacturer's instructions** and the IBC or IRC as applicable."

Has incomplete or unusable references as requirements and does not follow CP-28 guidelines:

*A-1.3.4 Open-Cell Spray Polyurethane Foam (SPF) Insulation 1. Installers shall meet the manufacturer's recommended training requirements and shall complete **the online health and safety training for SPF provided by the Center for Polyurethanes Industry**.* - Comment - This is an undated reference to an unknown web address and does not name the "document". Likely the "document" was not subject to ANSI or code compliant development process.

*A-1.3.6 Closed-Cell Spray Polyurethane Foam (SPF) Insulation ... Installers shall meet the manufacturer's recommended training requirements and shall complete **the online health and safety training for SPF provided by the Center for Polyurethanes Industry**.* - Comment - Again an undated reference to an unknown web address. It does not name the "document". Likely the "document" was not subject to ANSI or code compliant development process.

A-2.2 Structural Insulated Panels (SIPs) Grading Criteria 1. Sealing of panel joints shall meet the manufacturer's requirements. Where the manufacturer does not have specific joint sealing details SIPA's typical joint sealing details shall be used. SIPA details are available at www.sips.org. -Comment - Another undated reference to an unknown web address. Again it does not name the "documents". Likely the "documents" were not subject to ANSI or code compliant development process.

*A-2.3 Reflective/Radiant Grading Criteria ... 3. Where utilizing R-Values based on testing in accordance with ASTM C1224, the reflective insulation product shall be installed as tested. R-Value claims for the assembly including the airspace shall be based on ASTM C1224 or per the **current FTC Rule 460** requirements.* - Comment - It is inappropriate to reference the "current" version of something. FTC rules are not consensus documents. No section of the FTC rule is referenced.

RESNET'S new grade 1 insulation requirements are not ready and should not be required by code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The 11 pages of RESNET 301 Appendix A, plus adding multiple required referenced standards, would increase costs.

Disapproving the proposal would mean no change to code and therefore, no change in the cost of construction.

Public Comment# 2090

RE17-19

IECC: R401.2 (IRC N1101.13), R407 (IRC N1107) (New)

Proposed Change as Submitted

Proponents: Stephen Kanipe, representing Colorado Chapter (stephen.kanipe@cityofaspen.com); Nick Thompson, City of Aspen, representing Colorado Chapter of ICC Energy Code Development Committee (nick.thompson@cityofaspen.com); Mike Suhrbier, representing Self (mikes@sgm-inc.com)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.
4. The simplified equivalent compliance alternative approach in Section R407.

Add new text as follows:

R407 (IRC N1107) **SIMPLIFIED EQUIVALENT COMPLIANCE ALTERNATIVE**

R407.1 (IRC N1107.1) Scope. This section establishes criteria for compliance using heating and cooling load analysis.

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections R102.3, R403.5, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

R407.3 (IRC N1107.3) Equivalent HVAC building load. The ratio of the space cooling load and space heating load to *conditioned floor area* shall be less than or equal to the values in Table R407.3.

**TABLE R407.3 (IRC N1107.3)
COOLING AND HEATING LOAD PER SQUARE FOOT**

CLIMATE ZONE	COOLING LOAD PER SQUARE FOOT	HEATING LOAD PER SQUARE FOOT
0	10.1 Btuh	3.1 Btuh
1	8.9 Btuh	4.6 Btuh
2	11.6 Btuh	7.3 Btuh
3A and 3B	6.5 Btuh	8.5 Btuh
4A and 4B	7.6 Btuh	8.8 Btuh
3C	3.3 Btuh	5.8 Btuh
4C	6.0 Btuh	7.1 Btuh
5	7.0 Btuh	11.4 Btuh
6	5.5 Btuh	11.6 Btuh
7	4.9 Btuh	13.1 Btuh
8	4.0 Btuh	18.1 Btuh

**R407.4 (IRC N1107.4)
TESTING**

R407.4.1 (IRC N1107.4.1) Air leakage. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding the design infiltration rate in the load calculations. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

R407.4.1 (IRC N1107.4.1) Duct leakage. Ducts shall be tested in accordance with R403.3.3 and R403.3.4.

Reason: This is a refinement of previous code change proposal RE180-16. The committee recommended disapproval for the following reason: "This is a good concept that would be easy to use but the numbers need some refinement."

This proposal responds to the committee's comment on RE180-16 by providing specific compliance numbers for each climate zone. Weather data from representative cities of each climate zone as suggested by Pacific Northwest National Laboratory (PNNL) was entered in Wrightsoft Manual J software. Thermal envelope values (insulation, fenestration, air leakage) from the prescriptive 2018 IECC path for each climate zone was entered using the PNNL standard house design. This is consistent with PNNL protocol.

R407.2 includes requirements not addressed by heating and cooling load including service hot water, exterior energy use, and lighting. R102.3 is included to highlight the need for supporting mechanical system design documentation.

R407.4 requires testing to demonstrate the building is built as designed. A blower door test may not exceed the design infiltration rate in the load calculations. Ducts have the same testing requirements as the prescriptive path in R403.3.3 and R403.3.4.

The Simplified Equivalent Compliance Alternative provides the designer, engineer and builder team with another path to comply with climate zone equivalent energy performance targets. The peak heating and cooling loads are already calculated by the design team and drives the HVAC equipment size decision. This option rewards design work value that already exists.

This method is intended as an alternate method for complex residential buildings and HVAC system designs. Energy code compliance documentation at permit application will be greatly reduced as the compliance metric does not require volumes of paperwork.

This compliance path will shorten plan review time and reduce costs in both the public and private sectors.

The targets are fuel neutral.

Note 1- the climate zones are based on this table:

TABLE R301.3(2) INTERNATIONAL CLIMATE ZONE DEFINITIONS

ZONE NUMBER	THERMAL CRITERIA	
	IP Units	SI Units
0	10000 < CDD50°F	
1	9000 < CDD50°F	5000 < CDD10°C
2	6300 < CDD50°F £ 9000	3500 < CDD10°C £ 5000
3A and 3B	4500 < CDD50°F £ 6300 AND HDD65°F £ 5400	2500 < CDD10°C £ 3500 AND HDD18°C £ 3000
4A and 4B	CDD50°F £ 4500 AND HDD65°F £ 5400	CDD10°C £ 2500 AND HDD18°C £ 3000
3C	HDD65°F £ 3600	HDD18°C £ 2000
4C	3600 < HDD65°F £ 5400	2000 < HDD18°C £ 3000
5	5400 < HDD65°F £ 7200	3000 < HDD18°C £ 4000
6	7200 < HDD65°F £ 9000	4000 < HDD18°C £ 5000
7	9000 < HDD65°F £ 12600	5000 < HDD18°C £ 7000
8	12600 < HDD65°F	7000 < HDD18°C

For SI: °C = [(°F) - 32]/1.8.

Note 2 – We provided numbers for Climate Zone 0 using weather data from a CZ0 city (Dubai) but used thermal envelope R and U values and air leakage for CZ1 under the 2018 IECC.

WHAT TO LOOK FOR ON THE COMPLIANCE DOCUMENTS:

Following are example load calculations for climate zone 6 in Helena, MT. The heating load highlighted in the report is 27,725 Btuh; divided by the 2,400sqft conditioned floor area of this house gives a Btuh/sqft of 11.55. This is less than the value in table R407.3 and therefore complies. A similar calculation can be done for the cooling load. This house will need to pass a blower door test of 1080cfm at 50 Pa per the highlighted infiltration value in the report.

Design Information

Weather: Helena Regional, MT, US

Winter Design Conditions		Summer Design Conditions	
Outside db	-7 °F	Outside db	90 °F
Inside db	68 °F	Inside db	75 °F
Design TD	75 °F	Design TD	15 °F
		Daily range	H
		Relative humidity	30 %
		Moisture difference	1 gr/lb

Heating Summary		Sensible Cooling Equipment Load Sizing	
Structure	27725 Btuh	Structure	13980 Btuh
Ducts	0 Btuh	Ducts	0 Btuh
Central vent (0 cfm)	0 Btuh	Central vent (0 cfm)	0 Btuh
(none)		(none)	
Humidification	0 Btuh	Blower	0 Btuh
Piping	0 Btuh	Use manufacturer's data	n
Equipment load	27725 Btuh	Rate/swing multiplier	0.95
		Equipment sensible load	13253 Btuh

Infiltration		Latent Cooling Equipment Load Sizing	
Method	Blower door	Structure	19 Btuh
Shielding / stories	3 (partial) / 2	Ducts	0 Btuh
Pressure / AVF	50 Pa / 1080 cfm	Central vent (0 cfm)	0 Btuh
		(none)	
Area (ft²)	Heating 2400	Equipment latent load	19 Btuh
Volume (ft³)	21600	Equipment Total Load (Sen+Lat)	13272 Btuh
Air changes/hour	0.31	Req. total capacity at 0.70 SHR	1.6 ton
Equiv. AVF (cfm)	113		
	Cooling 2400		
	21600		
	0.15		
	53		

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections ~~R102.3~~ R103.2, R401.3, R403.5, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

R407.3 (IRC N1107.3) Equivalent HVAC building envelope load. The ratio of the ~~space cooling load and space heating load envelope loads~~ to conditioned floor area shall be less than or equal to the values in Table R407.3. Heating and cooling envelope loads shall be calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

Committee Reason: This is a clean simple compliance path, it increases flexibility by adding another option, focuses not on materials but efficiency. The modifications clarified that the language applies to envelope load and it does not impact equipment efficiencies or lighting, corrected the citation, and added as mandatory the certificate (Vote: 6-5).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: R401.2 (IRC N1101.13), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New), R407.3 (IRC N1107.3) (New), TABLE R407.3 (IRC N1107.3) (New)

Proponents:

Graham Wright, Passive House Institute U.S., representing self (graham@passivehouse.us)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R401.2 (IRC N1101.13) Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.
4. The simplified equivalent compliance alternative approach in Section R407.

R407 (IRC N1107) SIMPLIFIED EQUIVALENT COMPLIANCE ALTERNATIVE

R407.1 (IRC N1107.1) Scope. This section establishes criteria for compliance using heating and cooling load analysis.

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections R102.3, R403.5, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

R407.3 (IRC N1107.3) Equivalent HVAC building load. The ratio of the space cooling load and space heating load to *conditioned floor area* shall be less than or equal to the values in Table R407.3. Heating and cooling envelope loads shall be calculated in accordance with the ACCA Manual J Block Load method or other approved heating and cooling calculation methodologies.

**TABLE R407.3 (IRC N1107.3)
COOLING AND HEATING LOAD PER SQUARE FOOT**

CLIMATE ZONE	COOLING LOAD PER SQUARE FOOT	HEATING LOAD PER SQUARE FOOT
0	10.1 Btuh	3.1 Btuh
1	8.9 Btuh	4.6 Btuh
2	11.6 Btuh	7.3 Btuh
3A and 3B	6.5 Btuh	8.5 Btuh
4A and 4B	7.6 Btuh	8.8 Btuh
3C	3.3 Btuh	5.8 Btuh
4C	6.0 Btuh	7.1 Btuh
5	7.0 Btuh	11.4 Btuh
<u>5C</u>	<u>TBD</u>	<u>TBD</u>
6	5.5 Btuh	11.6 Btuh
7	4.9 Btuh	13.1 Btuh
8	4.0 Btuh	18.1 Btuh

Commenter's Reason: The pdf version of RE17-19 that came to me from Michelle Brit has quite a bit of text already in the Reason section, I am not sure why it does not show up in this portal, but part of it explains how the Table R407.3 was generated, as follows, "Weather data from representative cities of each climate zone as suggested by Pacific Northwest National Laboratory (PNNL) was entered in Wrightsoft Manual J software. Thermal envelope values (insulation, fenestration, air leakage) from the prescriptive 2018 IECC path for each climate zone was entered using the PNNL standard house design."

My main comment is that therefore, only the ACCA Manual J method should be accepted for the heating and cooling loads and not any other calculation methodologies, because the Table R407.3 is "calibrated" to that method. In my opinion additional such studies would be needed to generate performance tables pertaining to other methods. Presumably the table was generated with a Block Load (whole-building) type Manual J calculation, thus it is probably best to tie compliance to that specific method as well. I would question whether the language needs to say "envelope loads" as opposed to simply "loads". As I understand it Manual J standard procedure includes ventilation load as well, at least in some cases.

My secondary comment has to do with the granularity of the performance requirements. It is a bit surprising to me that Zone 3-6 are not distinguished as to A or B. I would suggest that at the very least a separate line should be added for Zone 5C as distinct from 5A,B, similar to what is proposed for Zone 3,4. FYI, I noticed that on the energycodes.gov page listing the representative cities, 5C is represented by Port Angeles WA, but the linked climate file is wrong - it points to Fairchild WA which is not the same place at all.

Postscript: The zone-by-zone approach is reminiscent of what we did for our PHIUS+ 2018 pilot phase program. For our final 2018 protocol though, we put a lot of study into making the heating/cooling load performance criteria vary *continuously* with climate factors, and also to be sensitive to building size and occupant density. The annoyance with zone boundaries is that there can be quite different designs required for buildings that are near each other but on different sides of the line. In most places that isn't a problem, but zone boundaries do happen to run through three of the largest metro areas in Canada (Toronto, Vancouver, Montreal) - this is irksome. I have attached screen shots of the PHIUS+ 2018 load criteria formulas just for illustrative purposes - they are not directly applicable to this proposal because they are calibrated to a different calculation method, and are predicated on greater stringency in air-sealing and window performance. The point is that more nuanced criteria might be something to consider as a future improvement. A larger study would need to be done to determine those.

$$\begin{aligned}
& 5.2001065557 \\
& + 1.0910602698 \cdot \text{EnvFlr} \\
& + 294.92913196 \cdot \text{Occ} \\
& + -0.000169585 \cdot \text{HDD65} \\
& + -0.085714432 \cdot \text{THD} \\
& + -0.043301638 \cdot \text{IGHL} \\
& + -3.920896922 \cdot \text{\$elec} \\
& + (\text{EnvFlr} - 1.766) \cdot (\text{EnvFlr} - 1.766) \cdot 1.0101270679 \\
& + (\text{EnvFlr} - 1.766) \cdot (\text{THD} - 19.736433333) \cdot -0.023102881 \\
& + (\text{HDD65} - 5860.0833333) \cdot (\text{THD} - 19.736433333) \cdot 2.5574756e-6 \\
& + (\text{EnvFlr} - 1.766) \cdot (\text{IGHL} - 22.692412967) \cdot -0.021908846 \\
& + (\text{IGHL} - 22.692412967) \cdot (\text{IGHL} - 22.692412967) \cdot 0.0010214681 \\
& + (\text{HDD65} - 5860.0833333) \cdot (\text{\$elec} - 0.2029333333) \cdot -0.00074824
\end{aligned}$$

$$\begin{aligned}
& -8.894257857 \\
& + 0.4779165041 \cdot \text{EnvFlr} \\
& + 178.12769665 \cdot \text{Occ} \\
& + 1.9044551e-6 \cdot \text{CDD50} \\
& + 0.1019963231 \cdot \text{TCD} \\
& + 0.0170829233 \cdot \text{IGCL} \\
& + (\text{EnvFlr} - 1.766) \cdot (\text{EnvFlr} - 1.766) \cdot 1.0406068504 \\
& + (\text{Occ} - 0.0027218) \cdot (\text{CDD50} - 4104.8333333) \cdot 0.0235455021 \\
& + (\text{CDD50} - 4104.8333333) \cdot (\text{CDD50} - 4104.8333333) \cdot 2.1816386e-8 \\
& + (\text{EnvFlr} - 1.766) \cdot (\text{TCD} - 78.127) \cdot 0.0284904137 \\
& + (\text{TCD} - 78.127) \cdot (\text{TCD} - 78.127) \cdot 0.0009440729 \\
& + (\text{EnvFlr} - 1.766) \cdot (\text{IGCL} - 71.844689133) \cdot 0.0083066462
\end{aligned}$$

Bibliography:

Zone Representative Cities

https://www.energycodes.gov/development/commercial/prototype_models

Building America Guideline: Accurate heating and cooling load calculations

<https://www.nrel.gov/docs/fy11osti/51603.pdf>

PHIUS+ 2018 Standard-setting documentation

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction I concur with the comment in the pdf version, "This is an option that gives considerable freedom to the design team. Options and flexibility may lower construction cost."

Public Comment# 1983

Public Comment 2:

IECC@: R407.2 (IRC N1107.2) (New), R407.4.1 (IRC N1107.4.1) (New)

Proponents:

Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections R103.2, R402.4, R403.5, R403.6, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

~~R407.4.1 (IRC N1107.4.1) Air leakage.~~ ~~The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding the design infiltration rate in the load calculations. Testing shall be conducted in accordance with RESNET/IGC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.~~

~~Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.~~

~~During testing:~~

- ~~1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.~~
- ~~2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.~~
- ~~3. Interior doors, where installed at the time of the test, shall be open.~~
- ~~4. Exterior or interior terminations for continuous ventilation systems shall be sealed.~~
- ~~5. Heating and cooling systems, where installed at the time of the test, shall be turned off.~~
- ~~6. Supply and return registers, where installed at the time of the test, shall be fully open.~~

Commenter's Reason: I agree with the committees reason statement that this proposal increases flexibility. I think this new compliance path through the residential section of the IECC should be roughly equivalent to the other paths (Prescriptive, Performance, and ERI) though and as written it is not in two important ways. First by not including the Mandatory section R403.6 Mechanical Ventilation. Having three pathways through Code that do require Mechanical Ventilation and one that does not is very problematic from both a construction and a compliance perspective. Second, by replacing the mandatory Air Leakage section in the IECC (R402.4) with the new R407 Air leakage any cap on the air leakage of the dwelling is removed. This again creates un-equivalent paths and potential confusion in the field.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction This code proposal increases the flexibility of the IECC which theoretically will decrease the cost of construction. This public comment better aligns this new IECC-residential pathways with the existing pathways to create equivalency.

Public Comment# 2045

Public Comment 3:

Proponents:

Stephen Kanipe, representing Colorado Chapter (stephen.kanipe@cityofaspen.com)

requests As Modified by Committee

Commenter's Reason: The original proposal was approved as modified by the committee and that decision was upheld during the floor motion online vote (61% to 39%) demonstrating that this is a well received proposal. We recommend that the committee decision be upheld.

The proposal meets the intent of the energy code:

"This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective."

The proposal is simple, flexible and offers an additional path for compliance allowing innovative approaches and techniques. It regulates the use and conservation of energy by creating an energy budget of a certain btu/sqft for each climate zone. It is a different way of measuring energy use than the prescriptive path which prescribes specific envelope components. The proposal converges with the prescriptive path for a PNNL standard 2 story slab on grade house. The prescriptive table will produce different energy use per square foot for different residential configurations because the two paths do not correlate. This should not matter from the perspective of using an energy budget as the "standard" as all house types in any one climate zone will use the same amount of energy per square foot.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Designers have a choice, not a requirement, to use this path. This is an option that gives considerable freedom to the design team. Options and flexibility may lower construction cost.

Public Comment# 1788

Public Comment 4:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests Disapprove

Commenter's Reason: In concept this proposal has much potential. But, it needs much work to realize that potential. The technical merit of this proposal as currently written is questionable and little meaningful justification has been provided with which to evaluate potential implications or inconsistencies with the other compliance paths. Any new compliance method, with or without the appeal of simplicity, should be shown to be at least equivalent to the current code. This has not been done and should be disapproved for that reason alone.

Some specific technical concerns are as follows:

- The reason statement doesn't provide comparison using whole building energy modeling to ensure equivalency with existing provisions of the code.
- It doesn't provide a means to ensure the load calculation method used or software meet criteria to ensure consistency with the whole building modeling basis of current provisions in the code.
- It allows "other *approved* heating and cooling calculations" without specifying any requirements for evaluating the acceptability or consistency of those calculations. This will create an approval burden on code officials without a basis for supporting approval or disapproval of any given calculation approach.
- There is also a disconnect between energy efficiency based on annual energy savings (as the bases for all existing compliance paths) vs. sizing of equipment based on peak load criteria which may only occur a small percentage of a year or season (e.g., a few days in the winter and a few days in the summer). The example load calculation doesn't provide enough information to make any reasonable comparison of the example building to prescriptive or performance requirements of the current compliance paths in the various climate zones.
- The proposal doesn't specify how to do the design load calculation in recognition that widely varying answers may occur depending on the user and assumptions that are undefined. Because of this, widely varying answers could occur within even a single climate zone and this is compounded by the expected variation in climate effects on peak loads, even within a given climate zone. This will leave this new compliance path unreliable without knowing whether the source of variability in solutions is caused by user assumptions or climate variations within a climate zone.
- It doesn't capture all mandatory provisions in Section R407.2 (thus, is not equivalent to code).

- Proposed Section R407.4.1 places no limit on the amount of air leakage that can be assumed for design and the proposal doesn't address what to do when the unspecified design ACH target for load calculation is not met when later tested. This will create enforcement and compliance problems.

- A similar proposal failed in the previous code development cycle as proposal RE180-16 and this proposal has not addressed or disclosed how it has addressed the relevant concerns resulting in the prior disapproval.

For the above reasons, the code development process, if robust, should not accept a new method of compliance without substantive and transparent justification to address and resolve the above concerns. We request your disapproval to allow this proposal to be further developed and return the next code cycle.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1618

Public Comment 5:

Proponents:

Ben Edwards, representing Mathis Consulting Co. (ben@mathisconsulting.com)

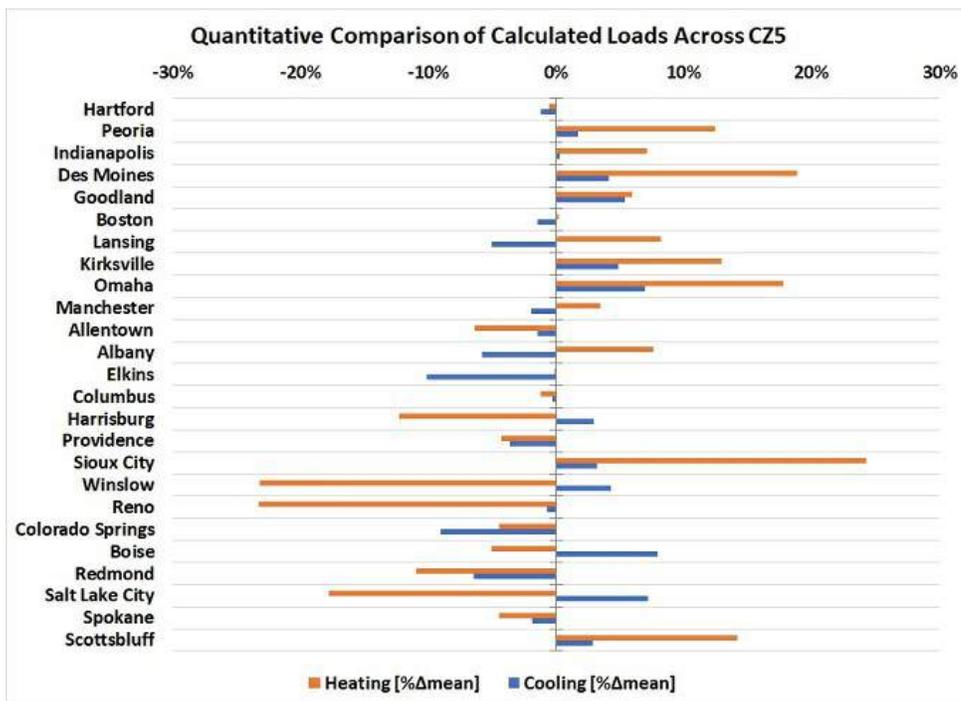
requests Disapprove

Commenter's Reason: Please disapprove RE 17. The reasons can be summarized as “FFF”:

- Fascinating future concept.
- Fatally flawed (for now - from a technical standpoint in its current form).
- Fixable (potentially, in a future code cycle).

The idea behind RE 17 – tie IECC efficiency requirements to the loads – is worthy of careful consideration. Everything about a building's energy performance starts with an accurate assessment of loads. Load calculations for equipment sizing have been required by the code for decades now (though often not properly prepared and submitted – another problem). So, from a code official's viewpoint, I have (should have) a useful code compliance tool already in my hand.

Unfortunately, while this loads-based concept has real potential, the graph below demonstrates just one of several “fatal” technical flaws in its current structure. This graph shows heating and cooling load variations for the same home (the same PNNL model that was supposedly used to generate the values in RE 17) for various locations within the SAME climate zone – in this case, Climate Zone 5. If one number for a climate zone was sufficient (as is proposed by RE 17) then all of these heating and cooling loads should be identical. Of course, they are not.



Big Problem #1. Not all locations in each climate zone are the same. In fact, NONE of them are. In CZ 5, for example, the Heating Degree Days ranges from 5400 to 7200. A simple look at the climate zone map suggests how much the individual locations in a climate zone may vary. So, we would expect the heating and cooling loads to vary significantly. A similar variance exists across all CZ 4 locations. And CZ 6 locations, etc. In fact, ALL climate zones defined by the code exhibit broad variation in loads. Therefore, ONE number for a loads-based code compliance option will not work at the climate zone level. This problem should be “fixable” in a future code proposal (after lots of effort) and may suggest improved utility for the code in the future – easier to comply and easier to verify. But not in its current form.

Loads calculators, like all such “tools”, suffer from a common problem – GIGO - garbage in, garbage out. Unfortunately, RE 17 provides no guidelines on how these proposed loads were calculated to determine the maximum loads in the proposal or how these loads are to be calculated for each individual home for compliance purposes.

“Following ACCA Manual J procedures” alone is far from enough. How was the proposed maximum load value determined? What diversity factor was used? What building orientation? Were the mandatory measures in code included in the calculations? What were the values used for maximum allowable envelope leakage? Duct Leakage? What other important modeling assumptions were used in the “Manual J” calculation to reach that value? Many assumptions and inputs have a significant impact on “loads”.

If we had the actual models and assumptions used, then we might be able to replicate the values proposed and compare them to the loads in the proposed 2021 (or current 2018) prescriptive table requirements. We could make sure that multiple compliance paths yielded similar results too.

Big Problem #2. We have to be able to replicate the values proposed. The proposal as written does not provide enough data to verify the accuracy of the proposed maximum loads values or specify the necessary “rule set” that all users must follow in doing compliance analysis. There is no published technical paper nor sufficient information in the reason statement to verify the numbers and their potential utility in the code. These problems may also be “fixable” – but the current proposal lacks these critical details.

One positive aspect of this “loads-based code compliance” idea is that it partially addresses the building economics “life cycle” question. Building envelope decisions – those that critically define the loads – are often the longest-lived elements in a building, lasting 40, 50, even 100 years. NAHB even notes that the life expectancy of insulation in buildings often lasts over 100 years. By comparison, equipment, appliances and other contributors to loads and meeting them, often last 10, 12, 15 or 20 years. So, a loads-based code begins to properly value life expectancy of durable envelope measures. (Do we know how long PV systems will last?)

Big Problem #3. What are the other necessary requirements applicable to this new compliance method to ensure reasonable results? For example, what sort of reports, compliance process, quality assurance and reviewer independence are required? There is no specification in the proposed new code section as to these critical items. Why aren't the standard mandatory requirements applicable? What other requirements are necessary? These problems may also be “fixable” – but are not addressed in the current proposal.

Again, the concept behind RE 17 has potential. I believe it also may be fixable. But not with the current “just add yet another compliance path” approach. The “fix” would be to use this approach to define the “energy budget” or a “loads budget” for a given location that can be used to demonstrate compliance. We could actually determine what the maximum load should be for every location, potentially for every zip code with a

weather file.

This concept has the potential to truly simplify the code as well as simplify code compliance. "Are you under the load budget? If so, good to go!"

While this concept may ultimately provide some benefits, in its current form there are serious technical flaws. As another example, the values proposed are in terms of "per square feet". So, if I don't meet the code with my current design, why not just make the house bigger until I do? This "size bias" was discussed in detail last code cycle and the Section R406 ERI path now has provisions for addressing the larger-than-average home situation. Where does RE 17 address that?

I have listed a few of the technical flaws here, but this topic requires considerable additional analytics, which will likely reveal other challenges and issues to work through.

FFF. The loads-based concept is a fascinating, and potentially transformational concept. It has several fatal technical flaws in its current form. And, with some real effort, potentially fixable for future code cycles.

This last part – "fixable" – is important. The "fix" will involve rethinking this concept, providing transparency on where the numbers came from and the variables used to generate them, the assumptions and safety factors, etc. With a bit of effort, we could do a robust assessment of loads that are made much more locally relevant and avoid the inherent problems that come from using one value to cover the huge variations in heating degree days and cooling degree days within a given climate zone.

In addition, the "fix" could expand the impact and reach of the IECC and include other "locally relevant" inputs – such as utility impacts (fuel mix, time-of-use, time-dependent costs, etc.), microclimate impacts (orientation, size adjustments, etc.), and perhaps tie all of the other code compliance structures together under a common umbrella that actually delivers on the energy performance promise implied by the code. Easier for builders. Easier for code officials.

I'm confident if we focus on this last "f" we will set the IECC on a much more impactful course for its future. Please reject RE 17 and let's get to work on the fix.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1950

Public Comment 6:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EEC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it will roll back energy efficiency by creating an entirely new and unnecessary compliance option that could result in substantial negative unintended consequences and would have a substantial negative impact on energy conservation, cost and occupant comfort in many cases. We are also very concerned that this new path could allow code users to completely bypass important minimum code requirements and safeguards, with no guarantee that these homes will perform as well as homes built to the established IECC compliance options. It would also provide a less stringent alternative for some buildings that could not pass the other compliance options, essentially creating a loophole that would allow homes to be built that otherwise would not comply with the current code.

While this proposal was recommended for approval as modified by the Committee by a 6-5 vote, the favorable vote included all four builder representatives (the vote was 5-2 against RE17 without the builder votes). In our view, while the underlying concept may have some potential if it is properly developed and thoroughly studied and fleshed out, this option needs far more analysis and study before being seriously considered as yet another compliance option in the code.

- **RE17 lacks sufficient technical analysis and justification.** The reason offered by the proponents does not provide sufficient information as to how the heating and cooling load compliance targets were derived for each climate zone (the proposal simply shows one example of a complying building in one location, which does not address the validity of the proposed load targets). These targets are crucial as they govern code compliance for all homes using this proposed path, yet we do not know what assumptions were made as to the many variables that would affect the ultimate proposed target.

Moreover, there is no sensitivity or other analysis by proponents to show that the load values are robust, will consistently produce at least

equivalent energy efficiency to other code compliance paths, will correlate reasonably with energy usage and cost, and can be relied upon as reasonable energy efficiency targets. As a result, the proponent has not shown that the methodology is reasonable and the resulting targets can be relied upon for nationwide code compliance. Moreover, no other independent analysis has been provided. By comparison, before the ERI compliance path was added to the 2015 IECC, a number of stakeholders (including US DOE) completed in-depth analyses as to the ERI approach.

- **RE17 as written simply cannot produce comparable/equivalent energy efficiency to the current IECC because the proposal does not reflect the variations in cooling load and heating load based on the specific weather for each location in the climate zone.**

The IECC prescriptive path establishes certain specific efficiency measures for each climate zone. The other current IECC compliance paths allow trade-offs of these measures with “equivalent” measures (subject to certain limitations) based on simulations reflecting the applicable weather data for each location in each climate zone. For example, performance path compliance software such as DOE’s REScheck, compares the annual energy use of the standard reference design against the proposed design based on the weather data for the specific location. Unlike RE17, REScheck does not use average or “representative” weather data for the entire climate zone. The simulated performance path approach incorporated into REScheck properly recognizes that whether the proposed design is equivalent to the standard design depends hugely on the specific weather data for the specific location – for example, REScheck uses “280 TMY weather data files covering about 22,000 locations.... Both the proposed and standard designs use the same TMY weather data.” (RW Schultz, R Bartlett and ZT Taylor, *REScheck Technical Support Document* at 4.2 (March 2019)) By comparison, RE17 uses only 11 climates – effectively 11 sets of weather data. (By contrast, when a similar approach was used to develop the PHIUS+ 2015 program requirements, performance targets were developed for over 1,000 locations.)

To achieve equivalent energy efficiency to the current IECC, RE17 would need to establish much more granular heating and cooling maximum load values – different targets for each location based on the weather data for each location – and not just reflect average or representative data for the entire climate zone. By setting only a single maximum heating and cooling load value for each climate zone, RE17 vastly oversimplifies the analysis, resulting in maximum loads that are wrong for most or all locations in the climate zone. Since each different weather location in the climate zone would produce a different load value for the same home configuration, by definition, this approach will require either too much or too little efficiency depending on the location. The variation in loads between different locations in a single climate zone can be very large; this reason alone demonstrates that the proposal is simply not ready for code adoption.

To illustrate this problem, we chose two locations in CZ 2 (Houston and Phoenix) and two in CZ 5 (Chicago and Boise). We calculated the cooling and heating load in Btu/sq. ft. using Wrightsoft Manual J software and using the 2018 IECC requirements and PNNL standard house design (consistent with the approach outlined by the proponents). The results for each location are illustrated in the tables below:

Climate Zone 2 Weather Data Illustration

Heating or Cooling Load (Btu/Sq. Ft.)	RE17 CZ2 Proposed Target	Houston Load	Houston Variation from Target	Phoenix Load	Phoenix Variation from Target	Increase from Houston to Phoenix
Cooling	11.6	7.1	-39%	9.7	-16%	37%
Heating	7.3	7.1	-3%	5.6	-23%	-21%

Climate Zone 5 Weather Data Illustration

Heating or Cooling	RE17 CZ5 Proposed Target	Chicago Load	Chicago Variation from Target	Boise Load	Boise Variation from Target	Increase from Chicago to Boise
Cooling	7.0	6.5	-7%	7.1	1%	9%
Heating	11.4	13.1	15%	11.3	-1%	-14%

(Note: our analysis results may not exactly match what the proponents would produce since, as noted above, we do not know the other assumptions they made in their analysis. This is another one of the fundamental concerns with this proposed approach.)

- As is apparent, the results for each home vary substantially depending on the location even where both are in same climate zone. **Using the same targets for Houston and Phoenix, as proposed in RE17, makes no sense when the Phoenix cooling load is 37% higher than the Houston cooling load, while the Phoenix heating load is 21% lower. While the difference is not as great for Chicago versus Boise, a 9% increase in cooling load and 14% reduction in heating load are still very large.** Moreover, when comparing these loads to the compliance target, it is readily apparent that in many cases, the target is far too high, allowing a substantial reduction in energy efficiency as compared with the current IECC (where the target is too high, the efficiency in the home can be reduced until the load meets the target). On the other hand, in some cases, like Chicago, the heating target will be much too low. As a result, establishing a single heating and single

cooling load target for each climate zone is simply not reasonable and, as a result, in many locations will permit homes to be constructed that are clearly not equivalent in efficiency to homes built to other compliance paths of the IECC.

- **RE17 appears to create an exception from otherwise mandatory code requirements.** The IECC establishes mandatory provisions that apply to all current compliance paths. As an extension of these provisions, a great deal of work went into SEHPCAC's reorganization of the mandatory provisions of the IECC, and the resulting proposals (including CE42) have organized mandatory provisions into two tables that apply to the performance and ERI paths. By contrast, RE17 appears to bypass many of the mandatory provisions of the code, creating a huge loophole that can negatively affect homes built to this new compliance path. For example, homes built to the new path will not be required to meet maximum air leakage requirements required for all other homes. Similarly, there are no specific minimum requirements for duct insulation (including building cavities as ducts) or testing, mechanical ventilation, or thermostats, since the applicable sections of the IECC are not required to be met. If RE17 goes forward in some form, at a minimum, it must require compliance with the same mandatory provisions, just like the IECC requires for all other compliance paths (and above-code programs).
- **RE17 does not have adequate and balanced thermal envelope requirements.** The Energy Rating Index was the most recently added compliance option, but when it was adopted into the 2015 IECC, it came with specific language requiring compliance with mandatory requirements and the 2009 IECC prescriptive requirements for the thermal envelope. RE17 could be used to carry out substantial trade-offs among building component efficiencies that are not currently allowed in the IECC, but there are no safeguards like the ERI's thermal envelope backstop and the fenestration trade-off caps that would help ensure minimum efficiency of the building envelope. When a similar approach was followed for the Passive House Institute US 2018 requirements, mandatory requirements were incorporated, including compliance with the U.S. DOE Zero Energy Ready Home and ENERGY STAR Certified Homes, which include minimum thermal envelope efficiencies.
- **RE17 lacks sufficient accreditation, certification, software specifications and/or reporting requirements and is subject to substantially varying results depending on user assumptions.** The IECC lists a number of specific requirements for software and compliance reports under both the performance path and the ERI, and the ERI goes a step further in requiring the services of a trained professional (verification by an approved third party) to determine compliance under the ERI path. US DOE and other organizations have also provided substantial support and there exists a well-defined infrastructure for the compliance process embodied in these paths. By contrast, RE17 does not set any software or reporting requirements (other than simply requiring calculations in accordance with Manual J or other approved calculation methodologies), has no verification, certification or quality control process, and leaves code compliance wide open for mistakes in compliance and even gaming.

Some examples where the compliance analysis under RE17 may be conducted improperly (or may be subject to different assumptions and interpretations) include inputs related to home orientation, number of occupants, thermostat set point temperature, mechanical ventilation rate, outdoor design temperature, window shading, etc. The range of specifications for these items will produce substantial swings in the building loads, yet none of these items is even mentioned in the proposed code language, much less guaranteed to be utilized properly in the software and compliance process.

As an example of the potential impact of these specifications, we examined the impact of one variable -- building orientation -- on the values for the two cities in CZ 2. We used the same approach as described above as to location/weather data with the exception of distributing the window area on a real-world basis (30% of the fenestration on each of two opposing walls and 20% on each of the remaining two walls) to test the effect of varying the orientation. The impact of this approach is huge. Orienting the home east/west instead of north/south increases the cooling load in Houston by 15% and in Phoenix by 13%. While it would take a full-blown study to determine the model's sensitivity to various inputs across the various climate zones, as a further illustration we did look briefly at the effects of some of the other items on cooling loads in climate zone 5 between Chicago and Boise (we would expect significant impacts from these types of assumptions on heating load as well):

- The software user can specify the number of expected occupants – the addition of each occupant increased the cooling load by about 3%.
- The software user can specify the indoor temperature setpoint – simply changing the cooling temperature from 75 to 78 degrees reduces the cooling load by 6%.

- **RE17 lacks a cushion (unlike the ERI compliance path) to ensure that most homes complying under this optional path will be more efficient than under the IECC prescriptive path.** When the last new compliance path was added to the code (the ERI), target requirements were established at a level intended to provide a cushion so that there was a reasonable assurance that most homes complying with the new path were at least equivalent and ideally more efficient than one simply in compliance with existing paths. A reasonable cushion should be established in RE17 (by lowering the load values) in an effort to maintain and ideally increase energy efficiency, particularly given the other uncertainties related to the proposal.
- **RE17 leaves too many other important questions unanswered.** Far more analysis of this approach and potential requirements needs to be done before such a radical new compliance method is approved and implemented. For example, some of the additional questions that should be answered include: (a) do the results vary by the brand of software used and if so, how much? (b) to what degree do size, occupancy, ventilation, or other assumptions introduce bias into this approach (in other words, can larger homes or homes configured in a certain manner reduce their efficiency requirements relative to the same home complying with the prescriptive path)? (c) does a reduction in glazing area permit a reduction/trade-off of insulation, a practice that has been rejected for several code update cycles? and (d) are there other actual or potential assumptions in the load calculations that may negatively impact the targets and/or compliance calculations?

- **RE17 sets a static efficiency requirement and will not necessarily reflect the efficiency of the 2021 IECC, much less future code improvements.** The standard reference design in the performance path incorporates improvements in prescriptive requirements as they are included in the code and thereby automatically keeps the compliance paths relatively consistent. RE17 sets a static target (purportedly reflecting the 2018 IECC) by locking in a set of numbers that – even if equivalent now – would need to be updated with each new edition of the code to maintain an equivalent level of efficiency with the other compliance options. In fact, if the improvements to the prescriptive path approved by the Committee during this cycle are ultimately approved, RE17 will already be starting behind, since the prescriptive path will already be more efficient in 2021 than the prescriptive values that are purportedly reflected in RE17.

RE17 is currently technically flawed, needs far more analysis and is missing key safeguards. Moreover, there has been no demonstration of need for yet another new compliance path. We strongly recommend that RE17 be disapproved.

Bibliography: RW Schultz, R Bartlett and ZT Taylor, *REScheck Technical Support Document* at 4.2 (March 2019).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1452

Public Comment 7:

Proponents:

Ryan Meres, representing RESNET (ryan.meres@gmail.com)

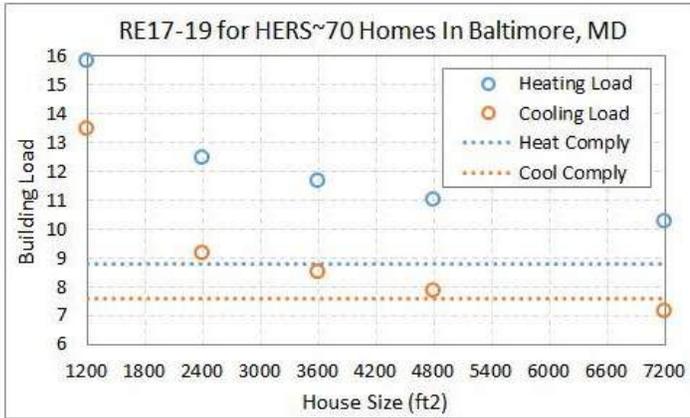
requests Disapprove

Commenter's Reason: RESNET encourages disapproval of RE17-19 for the following reasons:

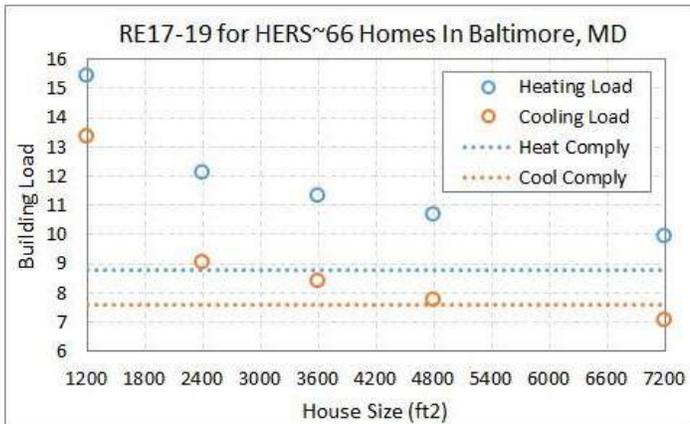
1. This proposal will be the first to take the unprecedented step of allowing a compliance path in the IECC that does not require compliance with all the mandatory requirements.
2. This compliance path would make it much easier for larger homes to comply with the IECC than smaller homes (see attached analysis)
3. This compliance path provides no guidance to code officials as to what to look for to verify compliance, nor what is required by the permit applicant to demonstrate compliance
4. This proposal provides no criteria for an "approved" third party or other qualifications for who conducts the calculations to determine compliance
5. With no requirement for what needs to be included on a report to the code official, this proposal provides a significant opportunity for "gaming" compliance.
6. In the reason statement for RE-17, the proponents state: "This method is intended as an alternative method for complex residential buildings and HVAC system designs". However, this is not reflected in the technical content of the proposal.

Overall, this proposal provides a significant loophole in compliance with a pathway that has little accountability for meaningful compliance.

Analysis of RE17-19 using Manual J8 Load Calculations in Energy Gauge Software



Notes: Insulation values approximately equal to 2012 IECC. HERS Index score of 70 based on RESNET/ICC 301. None of these homes fully comply with RE17-19, but it's clear that larger homes will have an easier time complying than smaller homes.



Notes: Insulation and air leakage values in compliance with 2018 IECC. Standard efficiency equipment. HERS Index in accordance with RESNET/ICC 301. No homes fully comply, but it's clear that larger homes will have an easier time complying than smaller ones.

Baltimore 2-story, 3-bedroom Homes minimally compliant with 2018 IECC							
2018 IECC		ManJ8 Loads		EUI (Btu/h-ft ²)		Compliance EUI	
CFA	HERS _{IAF}	heating	cooling	heating	cooling	heating	cooling
1200	66.2	18,541	16,037	15.45	13.36	8.8	7.6
2400	66.2	29,097	21,790	12.12	9.08	8.8	7.6
3600	66.7	40,892	30,358	11.36	8.43	8.8	7.6
4800	67.1	51,320	37,262	10.69	7.76	8.8	7.6
7200	67.8	71,529	50,860	9.93	7.06	8.8	7.6

Notes: Breakdown of results from the above chart.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

RE18-19

IECC: R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building envelope* air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. Where onsite renewable systems have been installed, the array capacity kilowatt size, inverter efficacy, panel tilt and orientation shall be noted on the certificate.

Reason: Four reasons why this proposal should be supported:

1. The Code requires that the efficiency rating of every energy-related building component of the home be observable or documented. Insulation R-values, furnace AFUE and water heater EF ratings, Window U-value and SHGC, as well as blower door and duct leakage testing results to name a few. Onsite renewables systems are the one exception which this proposal is striving to address.
2. The homebuyer must have access to knowledge of the energy comments of their home. The label required in Section R401.3 provides it with the notable exception of onsite renewables.
3. Green appraisal addendums and energy efficient mortgages are becoming more common in the market and the ability to easily gather the energy component information from a home is especially needed after the first sale. The certificate is to be a permanent feature of the home to allow the value of the efficiency features of the home to be recognized and assessed as an impact on the cost of ownership.
4. Lastly, third-party Inspection agencies, especially those working within section R405 and R406, need this information in order to develop compliance and marketing documents. The inclusion of onsite renewables on this certificate will change the renewable industry by ensuring that the information is passed on to all owners in a timely manner that does not impact receiving the certificate of occupancy or the closing of the home.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal would not impact the cost of construction. It does not require the inclusion of onsite renewables only the reporting of it when it is installed.

RE18-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The information is needed. Keeping records with the house makes sense, it is helpful to homeowners. Adds useful information for the future. (Vote 7-4).

Assembly Action:

None

RE18-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R401.3 (IRC N1101.14)

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building envelope* air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. Where onsite ~~renewable~~ *photovoltaic panel* systems have been installed, the array capacity-kilowatt size, inverter ~~efficacy~~ efficiency, panel tilt and orientation shall be noted on the certificate.

Commenter's Reason: RE18-19 was successful at the Committee Action Hearings.
This Public Comment includes editorial changes only.

As the language was targeted to photovoltaic panel systems, rather than any other form of renewable energy system, the defined term is used in this public comment.

Inverters have an efficiency associated with them, rather than efficacy. This might have been a typographical error in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and public comment only add a requirement for reporting parameters of onsite photovoltaic panel systems, and do not change the cost of construction.

Public Comment# 2174

Public Comment 2:

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests Disapprove

Commenter's Reason: RE18 requires inappropriate information on the panel label. The panel label is to help the consumer "comparison shop" homes. The panel label may sometimes help with upgrades or replacements, but the construction documents will often have more and better information.

Why is the inverter efficiency on the panel? The average consumer doesn't even know what an inverter is and certainly doesn't know what "inverter efficiency" is.

If there is a replacement system is that same inverter efficiency somehow a minimum requirement for the new inverter?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1938

RE20-19

IECC: R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: Jason Vandever, representing Self (jvandever@eepartnership.org)

2018 International Energy Conservation Code

Revise as follows:

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building envelope* air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. The certificate shall indicate the name of the builder who applied for the building permit, the code edition under which the structure was permitted and the compliance path used.

Reason: This is potentially valuable information to the homeowner or future contractor working on the home

Bibliography: N/A

Cost Impact: The code change proposal will not increase or decrease the cost of construction Adding a few items to a certification sheet doesn't cost anything. It is only documentation.

RE20-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Do not need builder's name on a certificate (Vote: 8-3).

Assembly Action:

None

RE20-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R401.3 (IRC N1101.14)

Proponents:

Robert Schwarz, Colorado Chapter of the ICC, representing Colorado Chapter of the ICC (robby@nrglogic.com); Gil Rossmiller, Colorado Code Consulting, LLC., representing Colorado Chapter, ICC (gilrossmiller@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on

a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*.
2. The *U*-factors of fenestration and the solar heat gain coefficient (*SHGC*) of fenestration. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area.
3. The results from any required duct system and *building* envelope air leakage testing performed on the *building*.
4. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. ~~The certificate shall indicate the name of the builder who applied for the building permit, the code edition under which the structure was permitted and the compliance path used.~~

Commenter's Reason: The committee stated that the builder's name is not needed on the certificate. Therefore that has been removed. The Colorado Chapter of the ICC believes that including the code under which the structure was permitted and the compliance path used on the label is valuable information that should be included on the certificate. In addition, the formatting of this section was borrowed from the disapproved proposal RE19 and was carried over here to more clearly highlight what needs to be included on the certificate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Adding a few items to a certification sheet doesn't cost anything. It is only documentation.

Public Comment# 1706

RE21-19

IECC: R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org)

2018 International Energy Conservation Code

Revise as follows:

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area-weighted average value if available. The certificate shall indicate the types, sizes and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.

Reason: The purpose of this code change proposal is to make minor but important updates to the certificate that will reflect changes made to the IECC in recent code cycles and include other information that will be beneficial for compliance purposes and for future homeowners. Most importantly, for homes with an Energy Rating Index score, the certificate will be required to provide the actual ERI score achieved with and without on-site generation (since the compliance requirements are different under each option). This proposal would also require the certificate to provide additional detail on thermal envelope efficiency (where available) and HVAC equipment size. This information should all be readily available at construction, and it will take very little effort to transfer it onto the permanent certificate. However, this information may be difficult or impossible to recreate down the road and will be useful for maintenance and future replacement. These are all reasonable improvements to the certificate that will benefit all future owners of the home.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The information required by this proposal will already be available at construction. The only change is to require the information to be recorded on the permanent certificate. Over the useful life of the home, we expect that putting this information in one place could save a homeowner significant money and effort.

RE21-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Confusing language related to area weighted average, and it would require an ERI score both with and without onsite generation (Vote: 10-1)

Assembly Action:

None

RE21-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.3 (IRC N1101.14)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of glazed fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area-weighted average value of the component if available. The certificate shall indicate the types, sizes and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. The certificate shall provide a summary of information related to compliance with this code, including listing the applicable code and the compliance path used. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, ~~both with and without~~ and whether it includes any on-site generation, shall be listed on the certificate.

Commenter's Reason: This proposal should be approved as submitted or as modified because it improves the certificate to include important additional information related to the building envelope and the use of on-site generation. Since the 2006 IECC, the permanent certificate has provided homeowners with straightforward, critical information about the energy-saving features of their homes. Consumer demand for information about the home has only increased since then, and RE21 provides important updates to the certificate.

The proposed modification addresses the two issues raised at the Committee Action Hearing:

- First, the Committee found the language related to area-weighted averaging “confusing.” The modification above clarifies that where the area-weighted average value for that component is available, it should be listed. Builders who use trade-off methods like the Total UA or who use REScheck for compliance will already have the area-weighted average fenestration *U*-factors and/or SHGC values, and it would make sense to include these instead of the *U*-factor or SHGC that covers “the largest area.” In any case, the revision above would only require including the weighted average if it is available.
- Second, the Committee was also concerned about builders having to provide an ERI score for the building both with and without the inclusion of on-site renewable energy (if any). This modification clarifies that only one ERI score is required to be listed on the certificate, but that the builder must indicate whether the ERI score includes on-site renewable energy or not. Because a different set of thermal envelope requirements apply depending on whether on-site renewable energy is included in the ERI score, we think it is crucial information for the code official to have. Without an acknowledgement by the builder as to whether on-site generation was used as part of the ERI calculation, it will be unclear which thermal envelope backstop applies.

These changes will not increase costs or create any real burden for the builder, but the changes will help facilitate compliance and enforcement as well as provide information for future owners when making future additions, alterations, repairs or replacements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The changes will not increase costs or create any real burden for the builder.

Public Comment# 1472

RE26-19

IECC: R402.1.4 (IRC N1102.1.4), TABLE R402.1.4 (IRC N1102.1.4), R402.1.5 (IRC N1102.1.5), R402.2.10 (IRC N1102.2.10)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Energy Conservation Code

Revise as follows:

R402.1.4 (IRC N1102.1.4) ~~U-factor alternative~~, or ~~F- factor alternative~~ An assembly with a *U*-factor or *F*-factor equal to or less than that specified in Table R402.1.4 shall be an alternative to the *R*-value in Table R402.1.2.

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS-FACTORSAND F- FACTORS***

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALLU-FACTOR	MASS WALLU-FACTOR ^b	FLOORU-FACTOR	BASEMENTWALLU-FACTOR	UNHEATED SLAB F-FACTOR	HEATED SLAB ^d F-FACTOR	CRAWLSPACE WALLU-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.73	1.03	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.73	1.03	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.73	1.03	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.54	0.68	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.54	0.68	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.48	0.68	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.48	0.68	0.055

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.
- d. *F*-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.2

R402.1.5 (IRC N1102.1.5) Total UA Component performance alternative. Where the proposed total building thermal envelope UA, the sum of *U*-factor times assembly area, thermal conductance, is less than or equal to the total UA resulting from multiplying the *U*-factors required total building thermal envelope thermal conductance using factors in Table R402.1.4 by the same assembly area as in the proposed building, the building shall be considered to be in compliance with Table R402.1.2. The UA calculation shall be performed total thermal conductance shall be shall be determined in accordance with Equation 4-1. Proposed *U*-factors and slab-on-grade *F*-factors shall be determined using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. In addition to UA total thermal conductance compliance, the SHGC requirements shall be met.

$$(U_p A + F_p P) < (U_r A + F_r P) \text{ (Equation 4-1)}$$

where:

$U_p A$ = the sum of proposed *U*-factors times the assembly areas in the proposed building

$F_p P$ = the sum of proposed *F*-factors times the slab-on-grade perimeter lengths in the proposed building

$U_r A$ = the sum of *U*-factors in Table R402.1.4 times the same assembly areas as in the proposed building

$F_r P$ = the sum of *F*-factors in Table R402.1.4 times the slab-on-grade perimeter lengths as in the proposed building

R402.2.10 (IRC N1102.2.10) Slab-on-grade floors. Slab-on-grade floors in contact with the ground with a floor surface less than 12 inches (305-600 mm) above or below grade shall be insulated in accordance with Table R402.1.2. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation

installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

Reason: to clarify how slab-on-grade UA calculations are to be done and provide an approved source for *F*- factor data. Although standard calculation procedures (such as ASHRAE's) cover the incorporation of slab conductances, and existing tools (such as REScheck) support slab perimeter insulation tradeoffs in the UA alternative, the code currently gives little direction on slab-on-grade component performance calculations. This clarifies the slab calculation.

This is clarification only; there is no direct impact on energy use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact since there is no change in requirements. This just clarifies how insulation for slab on grade can be treated in the UA tradeoff calculation.

RE26-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The clarification on slab on grade insulation levels is needed, but the numbers must be correct. They should be fixed in public comment (Vote: 10-1)

Assembly Action:

None

RE26-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.1.4 (IRC N1102.1.4)

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS AND F-FACTORS**

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	UNHEATED SLAB F-FACTOR	HEATED SLAB ^c F-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.73	1.03 0.74	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.73	1.03 0.74	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.73	1.03 0.74	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.54	0.68 0.66	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.54	0.68 0.66	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.48	0.68 0.66	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.48	0.68 0.66	0.055

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.
- d. *F*-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.2

Commenter's Reason: This is the public comment correction requested by the committee.

This updates the proposed F-factors for heated slabs (and uninsulated unheated slabs) that were slightly off from the final addendum in the 90.1 BX update of Appendix A.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This change provides a way of doing trade offs including the slab. As such it is not an increase or decrease, rather it is a tradeoff option.

RE27-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^g WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^g WALL R-VALUE
1	NR	0.75	0.25	30	13 or 0+10 ^h	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13 or 0+10 ^h	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h or 0+15 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h or 0+15 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^h or 0+15 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	30 or 20+5 ^h or 13+10 ^h or 0+20 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	30 or 20+5 ^h or 13+10 ^h or 0+20 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: This proposal does not change the stringency of insulation requirements for wood frame walls. The intent of this proposal is to: (1) include an additional equivalent insulation option for cavity insulation (currently an equivalent cavity insulation only option is missing in Climate Zones 6-8) and (2) provide for equivalent continuous insulation only options which are also missing. With the addition of these options, the table provides a simple yet complete set of insulation options for location of insulation on wood frame wall assemblies for each climate zone. This is intended to improve the usefulness of prescriptive options and show the full range of equivalent insulation options (e.g., cavity only, hybrid cavity + continuous, and continuous only). It is also intended to address concerns that the prescriptive table favors certain options over others by excluding viable options in some climate zones. This approach also provides more flexibility to coordinate insulation options with vapor retarder provisions in the building code which vary by climate as well as insulation strategy. With this flexibility, users can more readily choose between insulation options that provide equivalent assembly U-factor (as a minimum requirement of the energy code) yet have different capabilities and functions with respect to comfort, air-tightness, moisture control, thermal bridging mitigation, and other factors that are important to an overall code-compliant wall assembly. The thermal equivalency of the proposed options is demonstrated in the assembly U-factor analysis tables that follow.

R0+10 option:

Climate Zone 1 and 2 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	2 x 4 Wall	
	R-0 + R8.5ci	
	R-value Cavity Path	R-value Stud Path
Wall - Outside Winter Air Film ^A	0.17	
Siding - Vinyl ^A	0.62	
Continuous Insulation	8.5	

OSB - 7/16" ^A	0.62	
SPF Stud/Cavity Insulation	0	4.375
1/2 Drywall ^A	0.45	
Inside Air Film ^A	0.68	
16" o.c. Framing Factor ^A	75%	25%
Total Wall R-Values	11.04	15.42
Assembly U-Factor	0.084	
^A 2009 ASHRAE Handbook of Fundamentals		

NOTE: R-0 + R8.5ci is rounded to R-0 + R10ci to align with current convention for continuous insulation R-values in Table R402.1.1

R0+15 option:

Climate Zone 3, 4 and 5 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	2 x 4 Wall	
	R-0 + R13.2ci	
	R-value Cavity Path	R-value Stud Path
Wall - Outside Winter Air Film ^A	0.17	
Siding - Vinyl ^A	0.62	
Continuous Insulation	13.2	
OSB - 7/16" ^A	0.62	
SPF Stud/Cavity Insulation	0	4.375
1/2 Drywall ^A	0.45	
Inside Air Film ^A	0.68	
16" o.c. Framing Factor ^A	75%	25%
Total Wall R-Values	15.74	20.12
Assembly U-Factor	0.060	
^A 2009 ASHRAE Handbook of Fundamentals		

NOTE: R-0 + R13.2ci is rounded to R-0 + R15ci to align with current convention for continuous insulation R-values in Table R402.1.1.

R30 option (cavity only):

Climate Zone 6, 7 and 8 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	2 x 8 Wall	
	R-30 + R0ci	
	R-value Cavity Path	R-value Stud Path
Wall - Outside Winter Air Film ^A	0.17	
Siding - Vinyl ^A	0.62	
Continuous Insulation	0	
OSB - 7/16" ^A	0.62	
SPF Stud/Cavity Insulation	30	9.0625
1/2 Drywall ^A	0.45	
Inside Air Film ^A	0.68	
16" o.c. Framing Factor ^A	75%	25%
Total Wall R-Values	32.54	11.60
Assembly U-Factor	0.045	

^ 2009 ASHRAE Handbook of Fundamentals		
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NOTE: As shown in the calculation above, the R-30 cavity insulation only wall is dependent on thickness of framing (2x8) to satisfy the required maximum U-factor of 0.045. This is because the R-value of the studs (framing path) has an important effect on the overall effective R-value or U-factor of the assemblies with cavity insulation only. Where a 2x6 wall is used, R-38 insulation would be required because a 2x6 stud has a lower R-value than a 2x8 stud and, consequently, more cavity insulation R-value is needed to make up the difference (even though the cavity depth of a 2x6 wall is smaller). This is demonstrated in the table below. While R-38 insulation in a 2x6 wall cavity is possible, it can only be done with a limited selection of cavity insulation material with a 6.9 R/in or greater (i.e., closed cell spray foam). For this reason the proposal uses the R-30 (2x8) option which is more inclusive of various cavity insulation materials having an R-4.1/in or greater. Other options include combinations of cavity insulation materials that add up to R30 (e.g., flash and batt) or double-stud walls that can comply through the U-factor approach.

Climate Zone 6, 7 and 8 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	2 x 6 Wall R-38+0ci	
	R-value Cavity Path	R-value Stud Path
Wall - Outside Winter Air Film ^A	0.17	
Siding - Vinyl ^A	0.62	
Continuous Insulation	0	
OSB - 7/16" ^A	0.62	
SPF Stud/Cavity Insulation	38	6.875
1/2 Drywall ^A	0.45	
Inside Air Film ^A	0.68	
16" o.c. Framing Factor^A	75%	25%
Total Wall R-Values	40.54	9.42
Assembly U-Factor	0.045	
^A 2009 ASHRAE Handbook of Fundamentals		

R0 + 20 option:

Climate Zone 6, 7 and 8 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	2 x 4 Wall	
	R-0 + R18.7ci	
	R-value Cavity Path	R-value Stud Path
Wall - Outside Winter Air Film ^A	0.17	
Siding - Vinyl ^A	0.62	
Continuous Insulation	18.7	
OSB - 7/16" ^A	0.62	
SPF Stud/Cavity Insulation	0	4.375
1/2 Drywall ^A	0.45	
Inside Air Film ^A	0.68	
16" o.c. Framing Factor^A	75%	25%
Total Wall R-Values	21.24	25.62
Assembly U-Factor	0.045	
^A 2009 ASHRAE Handbook of Fundamentals		

NOTE: R-0 + R18.7ci is rounded to R-0 + R20ci to align with current convention for continuous insulation R-values in Table R402.1.1.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposal merely provides additional equivalent options for compliance to ensure no one approach or insulation material or its location on or in an assembly is preferentially treated over another in any of the climate zones.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This provides additional options for compliance. It simplifies code language and encourages users to look at all the associated issues (Vote: 8-3).

Assembly Action:

None

RE27-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: While having options is a good thing the concern with this option is when all the insulation is located on the exterior this is easier to be removed without replacing it. Having all the insulation on the exterior is less permanent than insulation found in the cavity. Exterior cladding is replaced all the time due to weather events or because the home owners are wanting a change. Chapter 5 states the alterations shall comply with the requirements for new construction. Section 503.1.1 states for the building envelope of alterations comply with requirements for new construction except for a list of 6 situations. As long as the energy use of the building is not increased. Number 3 of the exceptions states the thermal envelope requirements do not apply when construction of a wall cavity is not exposed. This exception would allow for the insulation to not be reinstalled, or at a minimum cause more confusion on how to enforce chapter 5's exceptions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1753

RE28-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: John Woestman, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ^f	FLOOR R-VALUE	BASEMENT ^g WALL R-VALUE	SLAB ^g R-VALUE & DEPTH	CRAWLSPACE ^g WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h 13&5ci ^h	8/13	19	5/13 ^f 5ci or 13 ^f	0	5/13 5ci or 13 ^f
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h 13&5ci	8/13	19	10/13 10ci or 13	10ci ^f , 2 ft	10/13 10ci or 13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^h 13&5ci	13/17	30 ^g	15/19 15ci or 19	10ci, 2 ft	15/19 15ci or 19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h 20&5ci or 13&10ci	15/20	30 ^g	15/19 15ci or 19	10ci, 4 ft	15/19 15ci or 19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h 20&5ci or 13&10ci	19/21	38 ^g	15/19 15ci or 19	10ci, 4 ft	15/19 15ci or 19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/5ci or 13" means R-10 R-5 continuous insulation (ci) on the interior or exterior of the home wall or R-13 cavity insulation on the interior of the basement wall. "15ci or 19" means R-15 continuous insulation (ci) on the interior or exterior surface of the home wall or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" "15ci or 19" shall be R-13 cavity insulation on the interior of the basement wall plus in addition to R-5 continuous insulation on the interior or exterior of the home wall.

d. R-5 continuous insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

- f. Basement wall insulation and crawl space wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, “13+5” insulation (ci), so “13&5ci” means R-13 cavity insulation plus R-5 continuous insulation in addition to R-5 continuous insulation (ci) and “13&10ci” means R-13 cavity insulation in addition to R-10 continuous insulation (ci).
- i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
- j. “10ci” means R-10 continuous insulation (ci).

Reason: This proposal is a clarification of insulation requirements in relation to cavity and continuous insulation applications. This proposal is intended to clarify compliance with Section R402.1.3.

In Table R402.1.2, “ci” is inserted wherever continuous insulation is a prescriptive requirement and / or option. Also, the “+” in several cells is replaced with “&” to more appropriately indicate the continuous insulation (ci), along with the cavity insulation, are both required where the CZ requires both. In footnote “c” replacing “and” with “in addition to” to clearly communicate in these situations both cavity insulation and continuous insulation are required.

In the basement and crawl space wall columns, the “/” is replace with “or” to clearly communicate either is acceptable (ci or cavity insulation).

Also, suggesting a bit of cleanup in footnote “c”. Footnote “c” is used for Basement Wall R-value and for Crawl Space Wall R-value. Use of “basement” in the footnote is not quite accurate since this footnote applies equally to basement or crawlspace walls. And, use of “home” is too broad. It seems the use of “wall” is better than the current text. And, in footnote “c” replacing “and” with “in addition to” to clearly communicate in these situations both cavity insulation and continuous insulation are required.

In the crawl space wall column, inserting footnote “f” similar to where footnote “f” is placed in the basement wall column, and modifying footnote “f” to include crawl space walls. It seems logical that crawl space wall insulation would be required – or not required – per the same criteria as basement walls.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There should be no cost implications as no technical changes are intended.

However, if adding footnote “f” to the crawl space wall column is a technical change, this proposal would decrease the cost of construction.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This gives clarity to users of the code (Vote: 11-0).

Assembly Action:

None

RE28-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.1.2, TABLE R402.2.6, TABLE C402.1.3

Proponents:

John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

**TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

**TABLE R402.2.6
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION R-VALUES**

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}

Commenter's Reason: This proposal is for consistency in IECC-R and IECC-C with the formatting revisions of proposal RE28-19.

IECC-R

In the tables identified, replace the "+" with "&". Also, append "ci" to the R-value numerical value for continuous insulation.

Table R402.1.2 and footnotes (and IRC Table N1102.1.2 and footnotes)

Table R402.2.6 and footnotes (and IRC Table N1102.2.6 and footnotes)

IECC-C

In the table identified, replace the "+" with "&".

Table C402.1.3

RE28-19, approved As Submitted during the CAH, proposes to modify the formatting of the requirements in IECC-R Table R402.1.2 (and footnote). The Committee agreed 11/0: "This gives clarity to users of the code."

This public comment proposes to revise other occurrences of "+" to "&" in IECC-R Table R402.1.2 for consistency of formatting, and to insert "ci" in several cells of this table should RE27-19 be approved. And, this public comment proposes to revise two tables which were outside the scope of the original proposal for consistency within IECC-R. Further, this public comment proposes to revise one table in IECC-C and consistency of IECC-C with IECC-R. Note that proposals RE23-19 and RE27-19 add text to several cells in Table R402.1.2 where the formatting should be consistent with RE28-19.

The proponent of this public comment suggests this public comment should not be needed as these purely editorial revisions (changing the "+" to "&" in the identified tables) could and should be addressed by the Code Correlating Committee. In addition, IF this public comment is allowed to be debated on the floor during the PCH, the entire proposal RE28-19 is exposed to the risk of disapproval during the PCH and subsequent OGCV. Conversely, assuming no other public comment is submitted on RE28-19; or if this public comment is the only public comment for RE28 and is withdrawn prior to the consent agenda action at the PCH, RE28-19 will be on the consent agenda for "As Submitted" at the PCH.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment is only editorial in nature and as such not affect the technical requirements of the code. The proposal does not add any technical requirements and therefore, the net effect of this public comment and proposal is no increase or decrease in the cost of construction.

Public Comment# 1969

RE29-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^e WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 20+5 or 13+10 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 20+5 or 13+10 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS^a**

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32	0.55	0.026	0.060 0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060 0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Reason: The purpose of this code change proposal is to upgrade and strengthen the requirements for wall insulation in climate zones 4 and 5 by making the requirements equal to the current requirements in climate zone 6. This will make homes more comfortable for occupants and reduce energy costs over the life of the building.

Because wall insulation is most cost-effectively installed during construction, walls should be insulated to the maximum cost-effective levels at that time, rather than expecting homeowners to upgrade them at some later date. This approach is consistent with the intent of the IECC (R101.3) to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

The proposed improvements represent the next step in commonly-available products and construction practices. Using DOE’s cost-effectiveness methodology, we found these R-values to offer substantial net life cycle savings and be clearly cost-effective for the homeowner/consumer in both climate zones:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
4	5.7%	\$1,605
5	4.3%	\$1,152

Bibliography: U.S. Dep’t of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* <https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology>.

Cost Impact: The code change proposal will increase the cost of construction. Requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE29-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Removing cavity only insulation option is a mistake, the net savings are not adequate. We need to comply with current code before we increase efficiency (Vote: 8-3).

Assembly Action: **None**

RE29-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.1.2 (IRC N1102.1.2)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUE ^f	FLOOR R-VALUE	BASEMENT ^g WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^e WALL R-VALUE
1	NR	0.75	0.25	30	13 or 0+10ci ^h	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13 or 0+10ci ^h	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5ci ^h or 0+15ci ^h	8/13	19	5/13 ⁱ	0	5/13
4 except Marine	0.32	0.55	0.40	49	30 or 20+5ci ^h or 13+10ci ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	30 or 20+5ci ^h or 13+10ci ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	30 or 20+5ci ^h or 13+10ci ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	30 or 20+5ci ^h or 13+10ci ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

- R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
- The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.
- "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- There are no SHGC requirements in the Marine Zone.
- Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
- The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5ci" means R-13 cavity insulation plus R-5 continuous insulation.
- Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

Commenter's Reason: The intent of this PC is to request approval of RE29 (as modified) for two purposes: (1) to align the proposed wall insulation changes in Climate Zones 4 and 5 with the changes already recommended for approval in RE27 and (2) to include all relevant and equivalent insulation options: cavity insulation only, cavity + continuous insulation, and continuous insulation only. Should RE29 be approved in public hearing to improve wall insulation requirements in Climate Zones 4 and 5, it is important to coordinate with RE27 by providing flexibility in the means of compliance. The changes in the other climate zones are no different than already recommended for approval in RE27(AM) at the committee action hearings and they do not represent any change in stringency in those climate zones. Also, the 'ci' designation is included to better differentiate the different insulation materials and locations on the assembly (consistent with the committee's approval of RE28). RE28 also replaced the "+" symbol with an "&" symbol with corresponding changes to footnote 'h' and, while not shown here for clarity, these correlations also are intended based on the final outcome of RE28.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The public comment merely aligns RE29 with RE27 which provided additional equivalent options for compliance to ensure no one approach or insulation material or its location on or in an assembly is preferentially treated over another in any of the climate zones. Therefore, net cost impact is limited to only Climate Zones 4 and 5 where economic pay-back justification was provided in the original RE29 proposal's reason statement (thus, resulting in a decrease in overall cost of ownership). There is no cost impact in the other climate zones for reasons given in RE27 which was recommended for approval as submitted by committee.

Public Comment# 1619

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it would improve energy efficiency and reduce energy costs by improving wall insulation requirements. Today's homes are being constructed to last 100 years or more, and some components (such as wall insulation) are likely to remain unchanged over the full lifetime of the building. As such, the efficiency requirements for these components should be carefully reviewed in each code cycle and tightened where reasonable to better ensure optimum efficiency and cost-effectiveness levels.

The Committee's stated concern about "removing cavity only insulation option" is off the mark because the IECC provides several alternatives for trade-offs, including the Total UA, the Simulated Performance Alternative, and the Energy Rating Index. Any one of these paths could be used to build an equivalent home with cavity-only insulation, as long as the reduced efficiency is accounted for elsewhere in the calculation.

As demonstrated in the original reason for the proposal, RE29-19 is one of the largest single improvements in residential energy efficiency for climate zones 4 and 5 and would result in substantial energy and cost savings and life cycle benefits for homeowners.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated in the original proposal, requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1473

RE32-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE ^f	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^g R-VALUE & DEPTH	CRAWLSPACE ^c WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0, 10, 2 ft	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 1/2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 1/2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

- a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: The purpose of this code change proposal is to increase energy savings and improve comfort by upgrading and improving slab insulation requirements for climate zones 3-5. Although most other components of the building thermal envelope have improved in recent years, the slab R-value requirements have not improved in any climate zone since at least 2006.

The improved values would produce substantial energy cost savings and life cycle cost benefits in all three climate zones:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
3	6.8%	\$3,132
4	2.5%	\$1,000
5	2.2%	\$1,076

Insulation can last for many decades and possibly the full useful life of the building, providing consistent comfort and energy saving benefits over that period, so it is particularly important to capture as much cost-effective energy efficiency as possible at construction. This is consistent with the intent of the IECC (R101.3), which is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."

Cost Impact: The code change proposal will increase the cost of construction

The additional insulation required will add to construction costs. However, our analysis shows that the improved efficiency will produce a clear life cycle benefit to the homeowner.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The cost impact does not justify the savings. The analysis was questioned and concerns expressed about constructability (Vote: 7-4).

Assembly Action:

None

RE32-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it increases the energy efficiency of the building and reduces energy costs through improvements in slab insulation, which is a part of the thermal envelope that has not been improved since at least the 2006 IECC. The measures are clearly cost-effective, particularly in climate zone 3, where homeowners stand to benefit from \$3,132 in life-cycle cost savings. Today's homes are being constructed to last 100 years or more, and some components (such as slab insulation) are likely to remain unchanged over the full lifetime of the building. As such, the efficiency requirements for these components should be carefully examined and tightened where reasonable to better ensure optimum efficiency and cost-effectiveness levels for each measure. The improvements in this proposal are straightforward and are already adopted in adjacent climate zones, suggesting that these improvements can be readily implemented in these climate zones as well.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated in the original proposal, the additional insulation required will add to construction costs. However, our analysis shows that the improved efficiency will produce a clear life cycle benefit to the homeowner.

Public Comment# 1474

RE33-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATEZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZEDFENESTRATION SHGC ^{b, e}	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE ^f	FLOORR-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE& DEPTH	CRAWLSPACE ^e WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38 49	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38 49	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS^a**

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030 0.026	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030 0.026	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Reason: The purpose of this code change proposal is to upgrade and strengthen ceiling insulation requirements in climate zones 2 and 3 by making the prescriptive values equal to current insulation requirements in climate zone 4 and higher. The proposal will make homes more comfortable and reduce costs for homeowners over the life of the building consistent with the objective of the IECC.

Small improvements to the thermal envelope have a significant impact, particularly in light of the long expected useful life of the home and the thermal envelope improvements. Insulation in particular may be undisturbed for many decades and possibly the full useful life of the building, providing consistent comfort and energy saving benefits over that period, so it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (R101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

Using DOE’s cost-effectiveness methodology, we found these R-value improvements to be cost-effective to the homeowner/consumer with a positive present value life cycle benefit:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
2	0.7%	\$42
3	0.9%	\$126

These proposed changes are also well within the range specified by the U.S. DOE’s insulation guidelines for climate zones 2 and 3 of R30 to R60. <https://www.energy.gov/energysaver/weatherize/insulation>

Bibliography: *Insulation*, Dep’t of Energy, <https://www.energy.gov/energysaver/weatherize/insulation> (last accessed Dec. 30, 2018). U.S. Dep’t of Energy, *Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes* (Aug. 2015), available at <https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology>.

Cost Impact: The code change proposal will increase the cost of construction. Requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Insufficient cost justification (Vote: 9-2).

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will conserve energy and reduce energy costs and bring added comfort to homeowners over the useful life of the building. An incremental improvement in attic insulation (essentially an additional 3.5 inches of blown insulation) will help maintain occupant comfort in all seasons. These insulation levels are sensible, cost-effective, and well within the levels recommended by U.S. DOE. Although the impact of this single improvement may seem relatively small in isolation (.7% to .9%), this is one of several EECC proposals aimed at optimizing the energy savings and cost-effectiveness of residential buildings. Together, these improvements to the thermal envelope will produce substantial energy and cost savings for homeowners.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated in the original proposal, requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1475

RE34-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^h U-FACTOR	GLAZED FENESTRATION SHGC ^{b, c}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ^{1, 2}	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE ^e WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^{h, g}	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^{h, g}	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^{h, g}	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^{h, g} or 13+10 ^{h, g}	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^{h, g} or 13+10 ^{h, g}	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

Reason: The purpose of this code change proposal is to improve the efficiency of homes in the coldest climate zones by removing an exception that allows weaker floor insulation R-values with no corresponding improvements elsewhere in the building. The current footnote “g” to Table R402.1.2 is a loophole that permits builders to reduce floor insulation (which will lead to a less comfortable home and increased energy costs), simply because of design choices made by the builder. Indeed, this exception allows builders in climate zones 7 and 8 to install *half* the insulation required by code.

The proposal above does not prohibit a builder from continuing to build floors with any specific floor joist thickness. However, if adequate insulation cannot be installed in the floor cavity, the energy efficiency losses must be accounted for elsewhere in the thermal envelope through a trade-off.

Cost Impact: The code change proposal will increase the cost of construction. However, the proposal will only increase construction costs for homes that might have taken advantage of this exception in the prescriptive path because it will require the installation of insulation sufficient to meet the R-value requirement in Table R402.1.2. However, this change will not increase costs for homes built to all other compliance paths in the IECC, since the footnote exception already does not apply to those homes. We believe the elimination of this exception will provide homeowners with the superior comfort and energy and cost-savings they expect from a code-compliant home.

RE34-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

**TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^c WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

- a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.
- b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. ~~Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.~~
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

- i. Mass walls shall be in accordance with Section R 402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Committee Reason: There are other options for trading off insulation and the footnote doesn't belong in prescriptive path. Additional insulation also contributes to fire barrier. The modification is necessary to correct unintended deletion of footnote. (Vote: 10-1).

Assembly Action:

None

Staff Analysis: The modification does not indicate the re-numbering (re-lettering) of footnotes that will occur if the proposal is approved.

RE34-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.2 (IRC N1102.1.2)

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)
requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

Portions of table not shown remain unchanged.

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT bU-FACTOR	GLAZED FENESTRATION SHGC ^{b, g}	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^e WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5h	8/13	19	5/13f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5h	13/17	30 ^j	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5h or 13+10h	15/20	30 ^j	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5h or 13+10h	19/21	38 ^j	15/19	10, 4 ft	15/19

- a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.
- b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- g. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- h. insulation *R*-value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. alls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
- j. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19 for existing homes utilizing Chapter 5 that are not sufficiently deep to install the required *R*-value or when obstructions in the cavity won't allow the full application of the required *R*-value.

Commenter's Reason: This footnote provides flexibility for the builders when dealing with these obstacles in real world applications, but still provides minimum guidelines for maintaining the integrity of the thermal envelope. The second portion of the footnote recognizes that during construction obstacles may impede the full R-value required in the floor cavity, and would allow for it to be reduced at the obstacle to an R-19. In a real world application obstacle are often found in the floor cavities especially floors over garages where duct work is often located. This table is utilized for compliance in Chapter 5 with alterations of existing buildings for the building envelope. While the list of exceptions to Section R503.1.1 allows for the existing floor cavities to remain as the existing conditions if the exposed cavities are filled with insulation. This exception would not address the floor systems that would be required to demonstrate compliance with Section R503.1.1 because the alteration is required to insulation the floors since they were not insulated previously. This sections refers you to utilize Table R402.1.2 for the required minimum values. Existing conditions may not allow for the full floor insulation value of an R-30 or R-38 as stated in table R402.1.2 due to the existing size of floor joist that was utilized, so the footnote allows for the minimum of an R-19 under these conditions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is returning the footnote to what it was originally.

Public Comment# 1757

Public Comment 2:

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)
requests Disapprove

Commenter's Reason: This footnote is needed when this table is utilized for projects that fall into the existing building portion of this code, Chapter 5. Existing projects may not have the floor joist size to install a full R-30 or R-38 into the cavity. This footnote gives options for these projects to comply with the intent of this code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1756

RE35-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATEZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZEDFENESTRATION SHGC ^{b, e}	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE ^f	FLOORR-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^c WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40 0.35 ^j	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32 0.30 ^j	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 exceptMarine	0.32 0.30 ^j	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30 ^j	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30 ^j	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30 ^j	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

j. A maximum *U*-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS^a**

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40 <u>0.35</u>	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32 <u>0.30</u>	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32 <u>0.30</u>	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall U-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall U-factor shall not exceed 0.360.

Reason: The purpose of this code change proposal is to improve occupant comfort and save energy by upgrading and strengthening fenestration U-factors in climate zones 2 – 4 (by lowering them consistent with modest step improvements in previous code cycles). Fenestration that meets these requirements is cost-effective and will return substantial life cycle savings to homeowners, is already widely available, and is routinely installed in new and existing residential buildings in these climate zones. This proposal also adds a footnote to establish an exception to prescriptive U-factors for fenestration installed at high altitudes (above 4000 feet in elevation) and in regions that require fenestration to be resistant to windborne debris in climate zones 3 - 8. A similar footnote exception was proposed in the last code development cycle and was widely supported by building code officials in these specific regions. Overall, this proposal will improve energy efficiency across much of the nation while allowing reasonable options for fenestration in high-altitude and wind-borne debris regions.

Energy Savings and Cost-Effectiveness - Our analysis, based on the DOE cost-effectiveness methodology, shows the improvements in U-factor to be cost-effective to the consumer with a substantial life cycle benefit:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
2	0.9%	\$275
3	1.0%	\$312
4	1.1%	\$523

Although we believe that the upgrade in the standards will result in no cost increase in most cases, because the new specification is consistent with the standard product already used in the marketplace (as discussed below), for purposes of the life cycle cost analysis above, we used a marginal upgrade cost to be conservative. Even with this approach, the life cycle benefit is robust.

Availability of Compliant Products and Adoption – A 0.30 U-factor requirement is a natural technology level/breakpoint representing a reasonably efficient, double pane, low-e with argon wood or vinyl window. As a result, a number of national and state programs have promoted fenestration U-factors in the range of 0.30 for several years, making these products widely available and already being installed throughout most of the country:

- For example, the American Recovery and Reinvestment Act of 2009 (ARRA) provided a federal income tax credit for fenestration with a U-factor of 0.30 or lower.
- Energy Star has required 0.30 U-factors (or less) for fenestration installed in all but the southernmost climate zones since January 1, 2015. See https://www.energystar.gov/sites/default/files/ES_Final_V6_Residential_WDS_Spec.pdf
- A recent EnergyStar market penetration report estimated that the share of total window products in the market already meeting the EnergyStar standard in 2016 was about 83%. (https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2016_USD_Summary_Report.pdf?8fd5-1967).
- These findings were reinforced through the U.S. DOE Residential Field Studies, which found that even in states in climate zones 2 – 4, with weaker code U-factor requirements, builders were routinely installing fenestration with U-factors around 0.30. See https://www.energycodes.gov/sites/default/files/documents/Field_Study_120715_Final.pdf.
- The state of California has recently upgraded its U-factor requirements for vertical fenestration statewide from 0.32 to 0.30, finding the lower U-factor cost-effective in all of its climate zones (California contains climate zones 2 – 6). See Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, *Residential High Performance Windows and Doors – Final Report* (Aug. 2017).

Because of these national trends toward 0.30 U-factor or better fenestration, compliance will not be an issue and in most cases will not even result in an increase in construction costs.

Proposed Exception for Special Circumstances - We believe that the proposed exception is warranted due to the special measures that are taken by glass and/or fenestration manufacturers to address higher altitudes and windborne debris due to high winds.

For example, high altitude products may incorporate breather or capillary tubes in the insulating glass unit to allow pressure equalization for products that will be transported to higher elevations for installation. The pressure equalization can help avoid IG unit failures. However, the capillary tubes eliminate the ability to use certain gas fills commonly used to achieve higher levels of thermal performance. The limited exception proposed above recognizes that circumstance and provides some flexibility for builders in these regions.

Likewise, fenestration designed to withstand windborne debris usually requires special glass which (because of its increased thickness) reduces the gap width in the insulating glass unit. This will affect the thermal performance of the window. To provide some additional flexibility in zones where such fenestration is required, this proposal permits a fenestration U-factor of 0.32 for climate zones 3-8.

In sum, we believe this proposal will implement meaningful energy and cost savings and improved occupant comfort through improved fenestration U-factors that are already available and are routinely being installed by homebuilders.

Bibliography: ENERGY STAR® Product Specification Residential Windows, Doors, and Skylights Eligibility Criteria Version 6.0, Energy Star, available at https://www.energystar.gov/sites/default/files/ES_Final_V6_Residential_WDS_Spec.pdf.

ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2016 Summary, Energy Star, available at https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2016_USD_Summary_Report.pdf?8fd5-1967.

Single Family Residential Energy Code Field Study, Building Energy Codes Program, available at https://www.energycodes.gov/sites/default/files/documents/Field_Study_120715_Final.pdf.

Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, *Residential High Performance Windows and Doors – Final Report* (Aug. 2017).

U.S. Dep't of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), available at <https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology>.

Cost Impact: The code change proposal will increase the cost of construction

It is possible that requiring more efficient fenestration may, in some cases, increase the cost of construction (and, as a result, we used an upgrade cost in our life cycle cost/benefit analysis), but in any event, the resulting energy and cost savings will overwhelmingly recoup the initial costs and will continue to benefit consumers over the useful life of the home. Moreover, it should also be noted that we would expect that the U-factor reduction will not increase costs in most cases, since the standard market products, with very high market penetration, already typically hit the proposed improved U-factor levels. We also note that for builders in high-altitude or wind-borne debris regions, the new footnote will provide additional flexibility and will likely serve to reduce costs.

RE35-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: It is an incremental improvement in efficiency, the windows are readily available and it is cost effective (Vote: 6-5).

Assembly Action:

None

RE35-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proponents:

Thomas Culp, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

Portions of table not shown remain unchanged.

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}
1	NR	0.75	0.25
2	0.35 0.40	0.65	0.25
3	0.30 ^j	0.55	0.25
4 except Marine	0.30 ^j	0.55	0.40
5 and Marine 4	0.30 ^j	0.55	NR
6	0.30 ^j	0.55	NR
7 and 8	0.30 ^j	0.55	NR

NR = Not Required. For SI: 1 foot = 304.8 mm.

- a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.
- b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
 - Exception:** In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.
- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
- j. A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:
 1. Above 4000 feet in elevation above sea level, or
 2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code..

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS^a**

Portions of table not shown remain unchanged.

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR
1	0.50	0.75
2	0.35 0.40	0.65
3	0.30	0.55
4 except Marine	0.30	0.55
5 and Marine 4	0.30	0.55
6	0.30	0.55
7 and 8	0.30	0.55

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Commenter's Reason: This public comment would accept the changes made to fenestration U-factor requirements in zones 3-4, but restore the current 0.40 value in zone 2 in order to avoid a conflict with the ENERGY STAR® program for Residential Windows, Doors, and Skylights. It is a widely agreed upon principle that Energy Star should be a notch beyond the base energy code. In some cases, code matches Energy Star such as in zones 3-4 in this proposal and with some other product types, but the value in zone 2 directly exceeds the Energy Star requirement (0.35 vs. 0.40). This creates a direct conflict. Even if rare, **this creates a scenario where an Energy Star labeled window could be sold to a consumer that does not meet code.** This is misleading to the homeowner, harmful to the Energy Star brand, and also creates potential problems for code officials who use the Energy Star label to check code compliance (in addition to the NFRC label). This issue was part of the debate when the code development committee disapproved RE24, RE30, and RE37, but the committee narrowly passed RE35 by only a 6-5 vote. If RE35 is going to go forward to make the changes in zones 3-4, this conflict in zone 2 must be removed.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As noted by the proponent, this proposal will marginally increase the cost of construction. However, this public comment will improve the cost effectiveness of the overall proposal by ensuring the code requirements do not exceed Energy Star in any zone.

Public Comment# 1559

Public Comment 2:

IECC®: TABLE R402.1.2 (IRC N1102.1.2)

Proponents:

Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, *}	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUE ^e	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^c WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.35 0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.30 ^f	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ⁱ	0	5/13
4 except Marine	0.30 ^f	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30 ^f	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30 ^f	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30 ^f	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

- a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.
- c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.
- j. A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:
 1. Above 4000 feet in elevation above sea level, or
 2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.

Commenter's Reason: WDMA is urging approval of this public comment to restore the current IECC U-factor requirement of 0.40 for vertical fenestration in climate zone 2. We are opposed to the proposed reduction to 0.35 in climate zone 2 because doing so exceeds and conflicts with the ENERGY STAR U-factor requirement applicable to windows in climate zone 2. Historically, the ENERGY STAR Windows, Doors and Skylights program has been an above code program which has helped fortify and promote the ENERGY STAR brand and use of above code ENERGY STAR qualified fenestration products. The ENERGY STAR qualified window label has also served as convenient and reliable means for verifying code compliance with the understanding that the ENERGY STAR criteria is equal to or more stringent than the energy code requirement in that climate zone. Those significant benefits will be undermined if the requirements of the IECC exceed those of ENERGY STAR and could also result in the inadvertent approval of non-compliant windows. Regarding the reductions in U-factors to 0.30 for Climate Zones 3&4 as proposed in RE-35, while they will be the same as the ENERGY STAR U-factor requirements applicable to windows in those zones, they do not exceed them. This public comment only intends for the IECC U-factor in Climate Zone 2 to be consistent in that regard and we urge approval of it for the reasons noted above.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. While this public comment may not increase or decrease the cost of construction, there is a greater benefit with respect to preserving the recognition of ENERGY STAR as an above code program for the reasons stated.

Public Comment# 1826

Public Comment 3:

Proponents:

Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

requests Disapprove

Commenter's Reason: Although we support the footnotes being added in this proposal to address impact resistant products and those for high altitudes, we must oppose this proposal based on the longstanding principal that Energy Star is supposed to be a notch above the code. The proposal would change the fenestration U-factor for Zones 3 & 4 to match Energy Star and for Climate Zone 2, the proposal goes beyond Energy

Star 6.0 requirements. This is a bad precedent to set and diminishes the Energy Star Program.

Proposal RE41-19, a joint proposal by the Window & Door Manufacturers Association and AAMA, was approved at the committee action hearings As Submitted. This proposal also addressed the impact resistant and high altitude products footnote that we support in RE35-19, but without changing the Table. Therefore, based on the changes to the fenestration U-factor requirements taking the code to Energy Star and above for Climate Zone 2, we believe this proposal should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If the code proposal is disapproved by this public comment, the net effect is no change to the U-factors; therefore, no increase in the cost of construction.

Public Comment# 1402

RE36-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4), R402.2.1 (IRC N1102.2.1)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATEZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZEDFENESTRATION SHGC ^{b, e}	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE ⁱ	FLOORR-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^e WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 exceptMarine	0.32	0.55	0.40	49 60	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49 60	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49 60	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49 60	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

**TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT U-FACTORS^a**

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 ^c	0.136
4 except Marine	0.32	0.55	0.026 0.024	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026 0.024	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026 0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026 0.024	0.045	0.057	0.028	0.050	0.055

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

R402.2.1 (IRC N1102.2.1) Ceilings with attic spaces. Where Section R402.1.2 requires R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-60 insulation in the ceiling, installing R-49 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

Reason: The purpose of this code change proposal is to improve comfort and save energy for homeowners in climate zones 4 - 8 by upgrading and increasing ceiling insulation requirements from R-49 to R-60. Small improvements to the thermal envelope can have a significant beneficial impact, particularly in light of a home's long expected useful life. Insulation in particular may not be changed for many decades and may last for the full useful life of the building, providing consistent comfort and energy saving benefits over that period. Making long-lived, life cycle cost beneficial improvements is consistent with the intent of the IECC (R101.3), which is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building." Using DOE's cost-effectiveness methodology, we found these R-value improvements would provide substantial life cycle cost benefits:

Climate Zone	Annual Energy Cost Savings
4	0.6%
5	0.7%
6	0.6%
7	0.5%
8	0.4%

These proposed changes are also within the range specified by the U.S. DOE's insulation guidelines for these climate zones. <https://www.energy.gov/energysaver/weatherize/insulation> A home with adequate insulation will maintain more consistent interior temperatures during both heating and cooling seasons and will be more resilient and livable in the event of extreme weather events and power outages.

Bibliography: *Insulation*, U.S. Dep't of Energy, <https://www.energy.gov/energysaver/weatherize/insulation> (last accessed Dec. 30, 2018). U.S. Dep't of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* <https://www.enr.codes.gov/residential-energy-and-cost-analysis-methodology>.

Cost Impact: The code change proposal will increase the cost of construction. Requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will

continue to benefit consumers over the useful life of the home.

RE36-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It impacts buried ducts, raised trusses and air barriers. The energy savings is within the margin of error (Vote: 11-0).

Assembly Action:

None

RE36-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will improve efficiency, reduce energy costs and bring added comfort to homeowners over the useful life of the building. An incremental improvement in attic insulation (essentially an additional 3.5 inches of blown insulation) will yield consistent benefits to homeowners in all seasons. These insulation levels are sensible, cost-effective, and well within the levels recommended by U.S. DOE. Although the impact of this single improvement may seem relatively small in isolation (.4% to .7%), this is one of several EECC proposals aimed at optimizing the energy savings and cost-effectiveness of residential buildings. Together, these improvements to the thermal envelope will produce substantial energy and cost savings for homeowners.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As stated in the original proposal, requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1477

RE37-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATEZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZEDFENESTRATION SHGC ^{b, e}	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE ^f	FLOORR-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^e WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR 0.40	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: The purpose of this code change proposal is to improve occupant comfort, reduce peak demand and HVAC sizing, and reduce costs for homeowners by establishing a moderate SHGC requirement for fenestration in climate zone 5. While we believe that the vast majority of fenestration installed in climate zone 5 already meets or exceeds this level of efficiency, and the performance path already assumes this same level (a 0.40 SHGC) for climate zone 5, this proposal will encourage the use of fenestration with proven efficiency and comfort benefits.

Comfort – A window that combines both a low *U*-factor (which is already required for climate zone 5) with a low SHGC will help reduce the volatility of interior temperature swings and better maintain reasonable occupant comfort. According to the Efficient Windows Collaborative, based on an analysis completed by Lawrence Berkeley National Laboratory, windows with lower SHGCs reduce the amount of solar radiation passing through the glass, which will reduce the likelihood of discomfort of occupants. See <https://www.efficientwindows.org/comfort.php>. An uncomfortable occupant due to excessive solar gain through windows is more likely to adjust the thermostat to a cooler temperature over the course of the day in response, thereby increasing peak demand and energy use.

Although energy modeling software does not typically capture the likelihood of occupant response to discomfort, anyone who has lived or worked in a building with excessive solar gain through fenestration, knows that this can lead occupants to adjust the thermostat. The energy impact of adjusting the thermostat is substantial. The following table shows the increased energy use that results from adjusting the thermostat down a single degree in a code-compliant house in each climate zone:

Increased Energy Use Resulting from Downward Thermostat Adjustment									
Measure	Weighted	1	2	3	4	5	6	7	8
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

Obviously, if an uncomfortable occupant adjusts the thermostat 2 or 3 degrees, the impact will be far higher.

Peak Demand and HVAC Sizing Savings – Low-SHGC fenestration helps reduce both the home and utility peak electric demand, providing a range of benefits for homeowners and communities. Low-SHGC fenestration helps reduce the need for air conditioning during peak hours when electricity is more scarce and more expensive. Reduced cooling needs can allow for the installation of smaller cooling equipment, benefitting the homeowner by lowering costs at construction and every time the air conditioning unit is replaced. Reduced peak electric demand for each home will also help curb the overall increases in utility peak electric demand, reducing costs and negative environmental impacts associated with installing and operating peak electric generation. See U.S. Department of Energy, *Measure Guideline: Energy Efficient Window Performance and Selection*, at 49, available at <https://www.nrel.gov/docs/fy13osti/55444.pdf>.

Market Availability - Given the U-factor requirement in climate zone 5 (currently 0.30), the overwhelming majority of products being installed in this climate are already well under a 0.40 SHGC. Indeed, according to a 2015 U.S. DOE field study of homes in Pennsylvania (which had no SHGC requirement), 100% of the observed fenestration SHGC was below 0.40. In fact, the highest SHGC observed was 0.32. See <https://www.energycodes.gov/compliance/energy-code-field-studies>. While this study was limited to one state and a limited sample, we have seen no evidence that the circumstances are different in other climate zone 5 states. Given the ubiquity of low-SHGC fenestration in climate zone 5, we believe that this proposal will not significantly change, but merely recognize practices already implemented by homebuilders.

Bibliography: U.S. Department of Energy, *Measure Guideline: Energy Efficient Window Performance and Selection*, available at <https://www.nrel.gov/docs/fy13osti/55444.pdf>.
Energy Code Field Studies, U.S. Dept of Energy, available at <https://www.energycodes.gov/compliance/energy-code-field-studies>.

Efficient Windows Collaborative, *Benefits: Improved Comfort*, available at <https://www.efficientwindows.org/comfort.php>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. We believe that the vast majority of windows being installed in climate zone 5 already meet this SHGC level, and for any that do not, there are many standard products in the market that will meet it for no additional cost (the vast majority of windows that meet the U-factors specified for climate zone 5 already have a lower SHGC than 0.40; the lower SHGC typically comes with the lower U-factor). A lower SHGC may also provide the opportunity to reduce the size of the HVAC system, thereby reducing construction cost. As a result, any increased or decreased cost impact is dependent on specific circumstances and is uncertain.

RE37-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: No technical data was provided, the cost savings were not justified, there is no energy savings (Vote: 8-3)

Assembly Action:

None

RE37-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will improve occupant comfort and help reduce air conditioner sizing, both of which will result in cost savings for homeowners. As explained below, we believe the Committee misunderstood the potential cost savings and other benefits for homeowners (see also the original reason for more details):

- First, the vast majority of windows available in climate zone 5 will already have SHGCs well below 0.40, since lower SHGCs typically accompany the lower U-factors required in this climate zone. This means no incremental cost increase. Even for those few windows that do not have a compliant SHGC, a simple change in low-e coating will achieve the SHGC requirement, at little or no additional cost.

- Second, new homes in climate zone 5 will almost certainly contain air conditioning equipment, which must be sized based on the characteristics of the building thermal envelope. Lower SHGCs reduce the size of the AC equipment needed, which will save money for builders and homeowners.
- Third, lower SHGCs improve comfort for the occupants of homes, making it less likely that they will adjust the AC thermostat. Improved comfort is not a trivial matter – as we noted in the original reason, even a one degree change in the cooling thermostat setpoint would increase total energy use by 1.8%.
- Given the low-to-zero marginal cost of this improvement, and the high likelihood that homeowners will be more comfortable and save far more costs on HVAC equipment, this proposal is a very sensible improvement to the IECC.

In addition to the consumer benefits, this proposal will help to reduce summer electrical system peak demands, which are largely driven by air conditioning loads.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As stated in the original proposal, we believe that the vast majority of windows being installed in climate zone 5 already meet this SHGC level, and for any that do not, there are many standard products in the market that will meet it for no additional cost (the vast majority of windows that meet the U-factors specified for climate zone 5 already have a lower SHGC than 0.40; the lower SHGC typically comes with the lower U-factor). A lower SHGC may also provide the opportunity to reduce the size of the HVAC system, thereby reducing construction cost. As a result, any increased or decreased cost impact is dependent on specific circumstances and is uncertain.

Public Comment# 1481

RE39-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), R402.2.1 (IRC N1102.2.1), R402.2.2 (IRC N1102.2.2)

Proposed Change as Submitted

Proponents: Greg Johnson, Johnson & Associates Consulting Services, representing Coalition for Fair Energy Codes
(gjohnsonconsulting@gmail.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATEZONE	FENESTRATIONU-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZEDFENESTRATIONSHGC ^{b, e}	CEILINGR-VALUE	WOODFRAME WALLR-VALUE	MASSWALLR-VALUE ⁱ	FLOORR-VALUE	BASEMENT ^g WALLR-VALUE	SLAB ^d R-VALUE & DEPTH	CRAWLSPACE ^c WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20 or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
Option 1										
6	0.28	0.55	NR	60	23 ^j	15/20	30 ^g	15/19	10, 4 ft	15/19
Option 2										
7 and 8	0.30	0.55	NR	49	20+5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19
Option 1										
7 and 8	0.28	0.55	NR	60	23 ^j	19/21	38 ^g	15/19	10, 4 ft	15/19
Option 2										

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the

- interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
- e. There are no SHGC requirements in the Marine Zone.
- f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
- g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
- h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
- i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
- j. Permitted only where the fenestration U-factor is 0.28 and the ceiling R-value is 60.

R402.2.1 (IRC N1102.2.1) Ceilings with attic spaces. Where Section R402.1.2 requires R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-60 insulation in the ceiling, installing R-49 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

R402.2.2 (IRC N1102.2.2) Ceilings without attic spaces. Where Section R402.1.2 requires insulation *R*-values greater than R-30 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation *R*-value for such roof/ceiling assemblies shall be R-30. Where Section R402.1.2 requires insulation greater than R49 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the required insulation R-value for such roof/ceiling assemblies shall be R38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.2 shall be limited to 500 square feet (46 m²) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

Reason: This proposal will save energy by providing a critically needed prescriptive cavity-only wall insulation option for Climate Zones 6-8 for the many builders and building officials that rely on the prescriptive table.

This new option provides equivalent energy performance by combining a minimum R23 wood frame wall *R*-value with better performing windows (*U*=0.28) and increased ceiling insulation (R60), such that equivalent energy performance is achieved.

The proposed R23 wall cavity insulation level is compatible with 2x6 framing using a variety of cavity insulation types, including several types of batt insulation products and blown-in insulation systems.

Verifying compliance in the field is easily done by checking the fenestration labels and insulation certificates and markers required by Sec. R303.

Note that this proposal does not modify the two existing continuous insulation assemblies already listed in Table R402.1.2, nor does it affect the U-factors in Table R402.1.4.

The proposed formatting of Table R402.1.2 in this proposal is identical to that of RE28-16 PC1 which was passed overwhelmingly by the assembly at the public comment hearings in Kansas City in 2016 before failing to achieve the supermajority by a single vote in online voting <https://www.iccsafe.org/wp-content/uploads/2016-GroupB-Final-Action-Results-OGCV.pdf>.

The energy efficiency of the proposed change was shown to provide better performance than the 2018 IECC using both an energy simulation analysis and a Total UA, REScheck analysis. Both analyses demonstrated better performance than the 2018 IECC. Both analyses used the U.S. Department of Energy Single Family Prototype for Determining the Cost Effectiveness of the 2018 IECC for house characteristics and square footage, in addition the simulated performance analysis uses U-factors and modeling guidelines in Sections R405.5.2(1) and R405.5.2(2) of the 2018 IECC for modeling the base or reference home.

1. Table R402.1.2 - Simulated Energy Performance Analysis:

Option:	Description:	MMBTU/YR ¹	Energy Cost YR ²	% Better
Base	Base 2018 IECC ³	87.4	\$1309.00	0.0%
Option 2 ⁴	R-23 wood frame wall, U-.28 vertical fenestration, R-60 attic	85.9	\$1292.00	0.3%

1. Whole Home MMBTU/YR

2. Whole Home Energy Cost/YR

3. Square footages and attributes taken from the US DOE Single Family Prototype for Determining the Cost Effectiveness of the 2018 IECC and modeling guidelines in R405.5.2(1) and R405.5.2(2) of the 2018 IECC.

4. Component U-factors calculated in accordance with the 2015 ASHRAE Handbook of Fundamentals.

2. Table R402.1.2 -Total Building UA Analysis (REScheck):

Option:	Description:	Overall U-Factor	% Better
Base	Base 2018 IECC ¹	313	0.0%
Option 2 ²	R-23 wood frame wall, U-0.28 vertical fenestration, R-60 attic	309	1.3%

1. Square footages and attributes taken from the US DOE Single Family Prototype for Determining the Cost Effectiveness of the 2018 IECC.

2. Component U-factors calculated in accordance with the 2015 ASHRAE Handbook of Fundamentals.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal offers an optional path for prescriptive envelope compliance. Because it is optional it cannot raise the cost of construction; a builder will choose whatever option they believe provides the greatest benefit for the cost.

RE39-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: A home with a lot of windows could perform worse, it presents a loophole and alternatives should be restricted to the UA alternative (Vote: 8-3).

Assembly Action:

None

RE39-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests As Submitted

Commenter's Reason: A majority of the committee voted against the proposal, having been influenced by inaccurate testimony, which claimed that proposed Option 2 might be less energy efficient in houses with a lot of window area. However, since Option 2 requires all windows to be 7% *more* energy efficient than the base prescriptive window U-factor requirement, a house with a lot of higher-performance windows actually improves energy performance compared to the same house with just as many lower-performance windows as permitted by the prescriptive table.

RE39 Saves Energy

Two analyses in the original proposal's reason statement, (R402.2.1 - Total Building UA Analysis (REScheck) and; R402.2.1 - Simulated Energy Performance Analysis), both demonstrate that RE39 reduces energy use. Both of these analyses used as a basis the U.S. Department of Energy's Single-Family Prototype for Determining the Cost Effectiveness of the 2018 IECC.

Two additional analyses also demonstrate that RE39 saves energy, as well as showing the impact of the improved Option 2 windows on energy efficiency.

- 1) REScheck modeling of a single 1800 sq. ft. house in Climate Zone 6 confirmed that increasing the area of higher performance windows from 15% to 18% to 20% saves more energy when a house is insulated according to proposed Option 2, resulting in a building envelope that is 5%, 5.2% and 5.5%, respectively, better than current base prescriptive code (Option 1).
- 2) A random sample of 10 house designs, supplied by the northern New York code jurisdictions where they were permitted, were analyzed in REScheck using the proposed Option 2 values. The ten house designs, with window areas varying from 8 to 19 percent, demonstrate that the Total UA of **Option 2 averaged 3.8% better** than the current base prescriptive code (see Table 1).

Table 1. REScheck Analyses of 10 Climate Zone 6 Houses Using Option 2¹

Square Footage	Glazing Area	Max UA	Proposed UA	Percent Above Code
1456	9%	176	171	2.8%
1586	14%	228	219	3.9%
1650	8%	260	254	2.3%
1652	10%	271	263	3.0%
1716	18%	293	282	3.8%
1814	14%	301	284	5.6%
1827	18%	252	239	5.2%
2100	16%	310	291	6.1%
2660	11%	348	349	(.03%)
3110	19%	329	298	5.6%
Average Percent Above Code				3.8%
¹ REScheck analysis using the 2018 IECC as the basis				

Approving RE 39 as submitted **will save energy** in two ways:

- 1) It will provide a more energy-efficient, easily constructed and easily verified Climate Zone 6-8 prescriptive option.
- 2) It will make the energy code more adoptable in cold climate states, where the current high prescriptive wall insulation levels, which require continuous insulation, are often amended to cavity only R19, R20 or R21 insulation *without* requiring prescriptive improvements in the envelope in some other way. This proposal corrects that problem.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The proposal provides for more flexibility in design which inherently reduces costs of construction. Builders can always choose the most cost-effective compliance option.

Public Comment# 2101

RE40-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT***

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^{b, e}	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^o WALL R-VALUE	SLAB ^o R-VALUE & DEPTH	CRAWL SPACE ^o WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 ^o or 13+5 ^h	8/13	19	5/13 ^f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 ^o or 13+5 ^h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 ^o or 13+5 ^h	13/17	30 ^g	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 ^o +5 ^h or 13+10 ^h	15/20	30 ^g	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 ^o +5 ^h or 13+10 ^h	19/21	38 ^g	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

- i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.
- j. R-18 insulation shall be permitted in place of the R-20 requirement provided that the wall framing factor is 20% or less of exterior walls having 24 inch on center nominal vertical stud spacing.

Reason: This proposal is an energy neutral change based on calculations from ASHRAE. Insulation that is R-19 that is compressed in a 2 x 6 wall with stud spacing at 24 o.c. performs like R-18. The ASHRAE Handbook of Fundamentals and ASHRAE Transaction 1995 Volume 101, Part 2 assumes that wood framed walls have a framing factor of 25%. Meaning 25 percent of the wall area consists of structural framing members and the remainder of the wall is a cavity suitable for installing insulation. When calculating the U-factor for a wall assembly, a high framing factor increases the overall assembly U-Factor. Reducing the framing factor will also provide an increase in the thermal performance of the wall. This proposal provides an option for a thermally equivalent tradeoff for 2x6 wall assemblies which have reduced framing factors and insulation performing like a R-18 insulator.

Below are the calculations showing equal U-Factors for both assemblies (0.060).

Wall Thermal Resistance by Component	2x6 Wall R-20 25%FF (16" o.c.)			2x6 Wall R-18 20% FF		
	R-Value Studs	R-Value Cavity	Assembly U-Factor	R-Value Studs	R-Value Cavity	Assembly U-Factor
Wall - Outside Winter Air Film ^A	0.17			0.17		
Siding - Vinyl ^A	0.62			0.62		
Continuous Insulation	0			0		
OSB - 7/16" ^A	0.62			0.62		
SPF Stud/Cavity Insulation	6.875	20		6.875	18	
1/2" Drywall ^A	0.45			0.45		
Inside Air Film ^A	0.68			0.68		
Studs at 16" o.c. ^A	25%	75%		20%	80%	
Total Wall R-Values	9.42	22.54		9.42	20.54	
Total Wall U-Factor	0.106	0.044	0.060	0.106	0.049	0.060

^A2009 ASHRAE Handbook of Fundamentals

Enemodal, 2001. Characterization of Framing Factors for Low-Rise Residential Building Envelopes (904-RP). Final Report prepared for ASHRAE, Atlanta, GA (USA)

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal will offer an optional way for compliance, by allowing a framing and insulation alternative to what is currently in the code without reducing the overall efficiency.

RE40-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The change supports advanced framing techniques which saves energy (Vote: 6-5).

Assembly Action:

None

RE40-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests Disapprove

Commenter's Reason: The committee reason statement in support of a narrow 6-5 vote recommending approval appears to have misunderstood the intent of this proposal. The proposal will not and is not intended to save energy. In fact, it may not even provide equivalent energy savings because it lacks sufficient guidance to ensure compliance and enforcement. This alternative is already capable of being addressed and is better addressed through the prescriptive U-factor equivalency approach. Adding this alternative as a footnote to the R-value table is not necessary and is an incomplete specification of advanced framing techniques which will result in unintended consequences.

For example, simply specifying 24"oc framing for layout of studs doesn't guarantee compliance with the intended 20% framing factor. Depending on structural conditions (e.g., beams, girder truss, etc.) which require stacked stud columns in an exterior wall, much more framing may be present than implied by a 24"oc framing layout. Depending on the amount, size, and placement of fenestration, many more jamb and king studs may be present despite the intention to use a 24"oc stud framing layout. One example of these conditions is shown in the photograph below (there are approximately 15 studs packed into this ~4-foot section of wall resulting in a FF of almost 50% -- not close to 20%).



Finally, if framing layout is to be considered as an explicit basis for energy code compliance (as insulation materials presently are), then the framing must be inspected for compliance with the intended framing factor (percentage of wall surface area). This will create an additional inspection burden for code officials and potential for non-compliance. This could be resolved by requiring framing shop drawings for wall framing to help verify compliance in plan review and field inspections, but the proposal does not require it. This request for disapproval does not deny the benefits of “advanced framing” but the use of this approach requires additional effort to ensure compliance and enforcement for the intended performance. Consequently, this option may be better implemented through an “additional energy efficiency packages” or “flex points” approach as proposed by others whereby it would be used for additional energy savings, not as a means for baseline compliance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1620

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EEECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is an efficiency rollback. Under the current code, R-20 is required prescriptively regardless of the framing factor. By creating a specific prescriptive trade-off between framing factor and insulation in this instance, this proposal reduces energy efficiency in cases where R-20 is currently being installed in walls with improved framing factors. Moreover, limited prescriptive trade-offs of this type are unnecessary, confusing, and should not be permitted in the code. Finally, although the reason references “R-19 that is compressed in a 2 x 6 wall ...” and the accompanying calculation appears to use a compressed R-19 batt, the new footnote reads “R-18 insulation shall be permitted in place of the R-20 requirement” This creates further confusion regarding this proposal and an even bigger rollback because it does not correctly represent the intent of the proponent that R-19 insulation be used. It should be noted that this proposal (submitted by NAHB) was narrowly approved by the Committee on a 6-5 vote, including all 4 builder votes.

To be clear, framing with a lower percentage of studs can improve energy efficiency, but not if the benefits are simply offset by less insulation. However, it is very difficult to define this circumstance in a way that it can be clearly enforced, particularly as a prescriptive option. Who is responsible for calculating the framing fraction of each wall? This trade-off might be equivalent in some circumstances *at best*, but at worst will result in walls nowhere near as efficient as simply installing the insulation required by the code. Because walls are unlikely to be retroactively insulated after they are finished, it is important to build them right the first time.

This proposal creates an unneeded option that is already covered under alternative compliance approaches included in the IECC. Additionally, it is implemented in a way that reduces the energy efficiency of the home and would be extremely difficult to enforce.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1482

Public Comment 3:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: This proposal to allow an R-18 cavity insulation value when utilizing 24"oc framing is a roll back on energy efficiency. Please review the information below provided by software.

- R18 – 16"oc = R16.3
- R18 – 24" oc = R16.793
- R20 – 16"oc = R17.234
- R20 – 24" oc = R17.815

If you are wanting to use a framing factor then the table that should be utilized is Table R402.1.4 (u-factor table). I do not believe the requirement of the 20% or less wall framing factor is something that most end users will be able to determine.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1750

RE43-19

IECC: R103.2 (IRC N1101.5), R202 (IRC N1101.6), R401.2.2 (IRC N1101.13.2) (New), R401.2.2.1 (N1101.13.2.2.1) (New), R405.4.2 (IRC N1105.4.2)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved by the code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.
9. Batch sampling plan (where applicable)

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

BATCH SAMPLING. Verification of energy code requirements when fewer than 100 percent of every dwelling or dwelling unit, within a sampled project are inspected, tested, or modeled for compliance.

Add new text as follows:

R401.2.2 (IRC N1101.13.2) Batch sampling. Batch sampling to determine energy code compliance shall only be allowed for stacked multiple-family dwelling unit projects within the same subdivision or community.

Exceptions:

1. Where sampling of energy compliance items for other than sections R402.4 and R403.3.3, an approved sampling plan shall be included in the construction documents and approved by the code official.
2. Where sampling is proposed for other than stacked multiple-family dwelling unit projects, an approved sampling plan shall be included in the construction documents and approved by the code official.

R401.2.2.1 (N1101.13.2.2.1) Sampling process. The sampling process shall follow these steps.

1. After five consecutive dwellings or dwelling units demonstrate compliance with the code without an incidence of failure, then only one dwelling or dwelling unit in subsequent batches of five dwelling units is required to demonstrate compliance through testing and inspection.
2. The remaining four units in the sampling batch shall be considered to be in compliance with the code when the one sampled unit in the batch of five dwelling units has demonstrated compliance.
3. Where the one dwelling or dwelling unit tested and inspected in the batch of five fails to demonstrate compliance with the code then that unit and 3 consecutive dwellings or dwelling units shall demonstrate compliance without incidence of failure before batch sampling is allowed to continue.

Exception: An *approved* sampling plan shall be used as an alternative to Section R401.2.2.1.

Revise as follows:

R405.4.2 (IRC N1105.4.2) Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* complies with Section R405.3. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a compliance report based on the as-built condition of the building shall be submitted to the *code official* before a certificate of occupancy is issued. ~~Batch sampling of buildings to determine energy code compliance shall only be allowed for stacked multiple-family units.~~

Compliance reports shall include information in accordance with Sections R405.4.2.1 and R405.4.2.2. Where the *proposed design* of a building could be built on different sites where the cardinal orientation of the building on each site is different, compliance of the *proposed design* for the purposes of the application for the building permit shall be based on the worst-case orientation, worst-case configuration, worst-case *building* air leakage and worst- case duct leakage. Such worst-case parameters shall be used as inputs to the compliance software for energy analysis.

Reason: Currently, sampling is only addressed within the Simulated Performance Path section R405 of the IECC. It states, "Batch sampling of *buildings* to determine energy code compliance shall only be allowed for stacked multiple-family units." Narrowing the allowance for sampling to stacked multi-family units makes a lot of sense but narrowing sampling to only the Simulated Performance path does not. This proposal broadens the ability to sample dwelling units regardless of the pathway used to navigate the IECC.

In researching this proposal, it became evident that sampling means something different to the code compliance community than it does to the verification and builder program community. My discussions with the code compliance community indicated that they believe that sampling is only a tool that is used for lessening the requirement of blower door and duct leakage testing every permitted dwelling unit. The verification and builder program community, on the other hand, uses sampling to verify compliance of any requirement of compliance. Therefore, this proposal states that sampling used for anything other than blower door or duct leakage testing must have a sampling plan submitted at permitting that is approved by the authority having jurisdiction. In this way, it is ultimately up to the jurisdiction to determine their comfort level with the use of sampling for other code compliance feature and building types than diagnostic testing and stacked multi-family dwelling units.

Currently, the code does not define in any way what sampling means. The second half of this proposal defines the minimum requirements for sampling, which not only offers guidance to the jurisdiction for what to expect but also offers a baseline for which to assess the merits of submitted sampling plans which may be submitted to potentially broaden the scope of what could be sampled.

In specific markets, such as Phoenix Arizona, sampling is a common occurrence and in others, it never occurs. This proposal ensures that regardless of where it is used that there is a common understanding of what it is and how it can be used for code compliance in comparison to compliance with programs such as EnergyStar or LEED for homes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. It is not clear how to assess the cost impact of a proposal like this as it depends completely on the quality of the installation of the code required item. If everything passes inspection the first time it can save money due to requiring fewer inspections, but if something fails it must be tested 3 more times and it could increase cost. The most important aspect of the proposal is not associated with cost it is associated with the ability to use sampling regardless of the compliance path chosen.

RE43-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: In favor for multi-family batch sampling, but not single family. The exceptions demonstrate that the language is too vague and should not be applicable to all compliance paths (Vote 9-2).

Assembly Action:

None

RE43-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R103.2 (IRC N1101.5), SECTION R202 (IRC N1101.6), (New), R401.2.2 (IRC N1101.13.2) (New), R401.2.2.1 (N1101.13.2.2.1) (New), R402.2.2.2 (N1101.13.2.2.2) (New)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.
9. Batch sampling plan (where applicable)

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

BATCH SAMPLING. ~~Verification of energy code requirements when~~ A process whereby fewer than 100 percent of all every dwelling_s or dwelling unit_s, within a sampled project being constructed are inspected or tested, or modeled for to demonstrate compliance.

R401.2.2 (IRC N1101.13.2) Batch sampling. Batch sampling ~~to determine energy code compliance~~ shall ~~only~~ be allowed for Group R2 buildings stacked multiple family dwelling unit projects within the same ~~subdivision or community~~. project or community for the purpose of demonstrating compliance with Sections R402.4 Air leakage and R403.3.3 Duct testing.

Exceptions:

1. ~~Where~~ If batch sampling of energy compliance items for other than Sections R402.4 air leakage and R403.3.3, duct leakage for other than Group R2 buildings an approved sampling plan shall be included in the construction documents and approved by the code official.
2. ~~Where sampling is proposed for other than stacked multiple family dwelling unit projects, an approved sampling plan shall be included in the construction documents and approved by the code official.~~

R401.2.2.1 (N1101.13.2.2.1) Sampling process.

Sampling shall use the following process: ~~The sampling process shall follow these steps:~~

1. After five (5) consecutive dwellings or dwelling units are tested and demonstrate compliance with Sections R402.4 Air leakage or R403.3.3 Duct testing the code without an incidence of failure, then only one (1) dwelling or dwelling unit in subsequent batches groups of five (5) dwelling units is required to demonstrate compliance through testing. ~~and inspection.~~
2. The remaining four (4) units using batch sampling in the sampling batch shall be considered to be in compliance ~~with the code~~ when the one (1) tested sampled unit in the batch group of five (5) dwelling units has demonstrated compliance.
3. ~~Where~~ If the one (1) dwelling or dwelling unit tested and inspected in the batch group of five (5) fails to demonstrate compliance with the code then that unit shall be retested until it demonstrates compliance and three (3) consecutive dwellings or dwelling units shall also demonstrate compliance without incidence of failure before Batch Sampling is allowed to continue.

Exception: An *approved* sampling plan shall be used as an alternative to Section R401.2.2 and R401.2.2.1.

R402.2.2.2 (N1101.13.2.2.2) Reporting. Batch Sampling reporting shall include the following:

1. At permitting, identify the number of sample sets that will use Batch Sampling.
2. At a time determined by the code official.
 - 2.1. Report units that demonstrate compliance and all addresses or lot numbers in the batch that create the sample set of five dwellings units.
 - 2.2. Report units that fail, and the date they are brought into compliance. Report the three or more additional units that are tested as a result of a failure, their test results, and the date the three consecutive units demonstrated compliance.
 - 2.3. Submit other compliance documents or reporting as required by the code official.

-
Committer's Reason: Public Comment Reason Statement

The committee demonstrated in their comments that they are in favor of multi-family batch sampling, and that it made sense to submit this public comment. The proposal was narrowed to directly address Group R2 buildings. However, there are jurisdictions, such as many in Arizona, that currently allow sampling in other building group classifications. Since the scope of sampling was narrowed to only blower door and duct leakage testing, there is an exception that allows for sampling if a sampling plan is approved by the code official.

RE157 removed sampling from Section R405, "The Simulated Performance Path". Multiple questions were raised in the Reason Statement that point to many concerns that the committee and others have had with sampling. I would like to address these questions and demonstrate how these issues were addressed in this proposal (RE43).

RE157 Reason Statement Questions: "The purpose of this code change proposal is to remove confusing and incomplete language from the performance path regarding 'batch sampling' of buildings."

- This revised proposal, RE43, removes confusion regarding batch sampling by moving language to an appropriate section of the code so that it could be applied to any pathway a builder chooses to use to demonstrate compliance.

RE157 Reason Statement Questions: "Section R405.4.2 contains orphan language that implies that batch sampling might be acceptable for stacked multiple-family units, but there is no process or criteria for 'batch sampling' defined anywhere in the IECC."

- Unless proposal RE43 is approved, there will continue to be no defined process or criteria for batch sampling in the IECC. At the committee action hearing, a definition of sampling in RE10 was approved. If process and criteria clarification of RE43 is not passed, then sampling may be randomly and haphazardly implemented in jurisdictions that decide to use it.

RE157 Reason Statement Questions: "Before any sort of sampling is allowed, a number of very important questions must be addressed, such as which parts of the building may be batch sampled, what sample size must be collected, what happens in the event of a failure, etc."

- Proposal RE43 addresses these concerns head-on. Unless there is an approved sampling plan, only blower door testing and duct leakage testing are allowed.
- Five dwelling units must fully demonstrate compliance and then sample sets of 5 units can be created. The sample size is therefore defined as 1 in 5. If you have 100 units and the first 5 are tested in their entirety, then you have 95 units left--or 19 batch sample sets of 5.
- RE43 clearly defines what happens if there is a failure. First, the unit that fails must be retested until it passes. Then three consecutive units must pass without failure before sampling can continue. All of this work must be reported to the code official.

RE157 Reason Statement Questions: "Although some common voluntary programs permit sampling for certain specified measures, the IECC does not currently allow this practice and should not until these important questions are addressed."

- The IECC did allow sampling in Section R405 only for the Simulated Performance Path. RE157 removed that. Now it is more ambiguous because RE10 defines sampling but the IECC does not define how to implement sampling. Some jurisdictions will interpret that sampling is allowed, and others will say that it is not.

RE157 Reason Statement Questions: "Moreover, we are concerned that batch sampling would fail to ensure that every home meets the code since presumably only some homes would be included in the sampling."

- After testing five dwellings for compliance, sampling of blower door and duct leakage testing is only required by one home in a batch of 5 when using sampling. This does not mean that sampling is a less robust compliance tool. Mandatory and other code compliance items are required regardless of sampling. In addition, the systematic nature of sampling reveals failures and the failure protocol increases testing rates to ensure there is no systemic failure that is not addressed. Sampling is an optional tool that makes sense for some projects and not for others. With the guidance of the code official sampling and now with a sampling protocol embedded in code, it can be used for projects where it makes sense.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. It is not clear how to assess the cost impact of a proposal like this as it depends completely on the quality of the installation of the code required item. If everything passes inspection the first time it can save money due to requiring fewer inspections, but if something fails it must be tested 3 more times and it could increase cost. The most important aspect of the proposal is not associated with cost it is associated with the ability to use sampling regardless of the compliance path chosen.

RE47-19

IECC: R402.2.4 (IRC N1102.2.4)

Proposed Change as Submitted

Proponents: Stephen Skalko, representing Marwin Company (svskalko@svskalko-pe.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.4 (IRC N1102.2.4) Access hatches and doors. Access doors from *conditioned spaces* to *unconditioned spaces* such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle or retainer shall be installed to prevent the loose-fill insulation from spilling into the living space when the attic access is opened. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

Exception Exceptions:

1. Vertical doors providing access from *conditioned spaces* to *unconditioned spaces* that comply with the fenestration requirements of Table R402.1.2 based on the applicable *climate zone* specified in Chapter 3.
2. In Climate Zones 1 through 4 horizontal pull-down stair-type access hatches in ceiling assemblies that provide access from *conditioned* to *unconditioned spaces* shall not be required to comply with the insulation level of the surrounding surfaces provided the hatch meets all of the following:
 - 2.1. The average U-factor of the hatch shall not exceed U-0.10 or have an average insulation R-value less than R-10.
 - 2.2. Not less than 75 percent of the panel area shall have an insulation R-value of at least R-13.
 - 2.3. The net area of the framed opening shall be less than or equal to 13.5 square feet, and
 - 2.4. The perimeter of the hatch edge shall be weatherstripped.

The reduction shall not apply to the U-factor alternative approach in Section R402.1.4 or the total UA alternative in Section R402.1.5.

Reason: A code change similar to this proposal was submitted to the IECC and IRC during the 2016 Group B code cycle (RE50-16). At the Code Action Hearing in Louisville, KY the IECC Code Development Committee (CDC) saw the logic of the proposal and recommended the change for Approval As Submitted. The CDC reason given was:

The practical implications outweigh the minimal loss of insulation R-value. Experience with products that can comply with these requirements is a superior method as compared what has been done in the past and provides for a long-term solution.

Their reason is consistent with our experience that the added insulation requirement in section R402.2.4 (N1102.2.4) is frequently achieved with "field crafted detachable apparatuses". Unfortunately, over time these are commonly discarded or worse, set aside compressing adjacent ceiling insulation thus defeating the intended benefit. The objective of this proposal is to address this field modification issue and provide for a more permanent installed solution.

During the 2015 ICC code development cycle for the IRC and the IECC an exception was added to the ceiling insulation requirements for vertical doors providing access to attic areas in IECC Section R402.2.4 and IRC Section N1102.2.4. This exception was based on the premise that vertical attic access doors between conditioned and unconditioned spaces can be treated as fenestration. Horizontally positioned attic access hatches are a similar issue. These horizontal hatches are being required to have insulation levels that match the surrounding ceiling which is significantly more stringent than skylight fenestration products located in these same ceiling assemblies.

For example, in Table R402.1.2 (N1102.1.2) Skylights are required to meet a U-factor that ranges from 0.75 in Climate Zone 1 to 0.55 in Climate Zone 8. In addition, Section R402.3.3 (N1102.3.3) allows up to 15 square feet of the fenestration per dwelling unit (which includes skylights) to be exempt from the requirements in Table R402.1.2 N1102.1.2). It does not make sense to require R-30 to R-49 insulation for a pull down stair type access hatch in an insulated ceiling when one can have a skylight up to 15 square feet in area that is exempt from the envelope requirements or that has a U-FACTOR of 0.55-0.75 (less than R-2). Insulating pull down stair access hatches to the levels specified in N1102.2.4 (R402.2.4), compared to the skylights insulation requirements is expensive, and in many cases not practical.

Because affordable, pre-manufactured pull-down stair access systems are not readily available to meet the R-30 to R-49 target field customization of access hatches is sometimes employed to achieve these performance levels. Inspection and verification for compliance becomes a challenge. As noted previously, long term system performance of these field customized entry devices may also vary. Commonly these "field crafted detachable apparatuses" are designed to be removed for attic access and placed on the adjacent attic joists. This results in the insulation being compressed thus reducing its effectiveness. Also providing sufficient air sealing around the hatch that remains durable long term is difficult. Finally, removal of the insulated covers for access may present a safety hazard to service personnel, inspectors and building owners having to stand on ladders while removing the hatches.

Quality standardized manufactured pull down stair systems however provide a safer, permanent access with proven performance for the life of the structure. Factory built energy rated access systems provide consistent air sealing performance and ensure consistent energy performance while helping to maintain air quality through reduced air infiltration.

This proposal provides a solution by permitting a reasonable reduction in the insulation values for pull down stair access hatches that are less than or equal to 13.5 square feet (approximately 30" X 64") in attic ceilings. This maximum size accommodates most manufactured products available. The U-value specified at U-0.10 is less stringent than the U-values specified for the insulated ceilings but is far more stringent than those permitted for skylights in all Climate Zones. Too the size limit is more stringent than that permitted for skylights which can have one unit up to 15 square feet in size exempted from the code requirements while all other skylights are less stringent than the pull down stair assembly proposed. Finally, the proposal also does not allow this reduction to be factored into the U-Factor alternative calculation procedure in R4002.1.4 (N1102.1.4) or the total UA alternative procedure in R402.1.5 (N1102.1.5). This is consistent with the limitations in Section R402.2.1 (N1102.2.1) for ceilings with attic spaces and in Section R402.3.3 (N1102.3.3) for skylights.

Though the previous code change RE50-16 was recommended for approval as submitted a public comment was submitted. At the Public Comment Hearing (PCH) in Kansas City, MO the commenter raised concerns about the impact of such reduced insulation levels in cold climates. The membership overturned the action of the committee and RE50-16 was disapproved.

The intent of this proposal is the same as the original proposal previously approved by the IECC Code Development Committee with two basic improvements.

1. The criteria that horizontal pull-down stair-type access hatches must meet has been formatted in a list format to aid the code user in determining the requirements to be met by this exception.
2. The reduced insulation level for these horizontal pull-down stair-type access hatches is limited to Climate Zones 1-4 in response to previous objections for this exception in cold climates.

Recommend the IECC Code Development Committee again take action to Approve As Submitted.

Cost Impact: The code change proposal will decrease the cost of construction
The reduced cost of field installed apparatuses and insulation will offset the cost of the pull-down stair

RE47-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification: R402.2.4 (IRC N1102.2.4) Access hatches and doors. Access doors from *conditioned spaces* to *unconditioned spaces* such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle or retainer shall be installed to prevent the loose-fill insulation from spilling into the living space when the attic access is opened. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

Exceptions:

1. Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of Table R402.1.2 based on the applicable climate zone specified in Chapter 3.
2. ~~In Climate Zones 1 through 4~~ Horizontal pull-down stair-type access hatches in ceiling assemblies that provide access from *conditioned* to *unconditioned spaces* in Climate Zones 1 through 4 shall not be required to comply with the insulation level of the surrounding surfaces provided the hatch meets all of the following:
 - 2.1. The average U-factor of the hatch shall ~~not exceed~~ be less than or equal to U-0.10 or have an average insulation R-value ~~less than~~ of R-10 or greater.
 - 2.2. ~~Not less than~~ At least 75 percent of the panel area shall have an insulation R-value of ~~at least~~ R-13 or greater.
 - 2.3. The net area of the framed opening shall be less than or equal to 13.5 square feet, and
 - 2.4. The perimeter of the hatch edge shall be weatherstripped.

The reduction shall not apply to the U-factor alternative approach in Section R402.1.4 or the total UA alternative in Section R402.1.5.

Committee Reason: This provides the user of the code an option for getting into the attic without the additional insulation. The modification fixed problems with initial proposal. (Vote: 9-2).

Assembly Action:

None

RE47-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: This option is only available if you are utilizing the prescriptive path in climate zones 1-4. Section 2.1 states for R-13 for a minimum of 75%. While climate zones 1-3 have an insulation of R-30 or R-38 climate zone 4 requires an R-49, so the R-13 is quite the reduction in insulation value required.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1761

RE49-19

IECC: R402.2.4 (IRC N1102.2.4)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.4 (IRC N1102.2.4) Access ~~hatches~~ hatch doors and doors-insulation retention. ~~Access~~ Vertical or horizontal access doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle, ~~retainer~~, or ~~retainer dam~~ shall be installed to prevent the loose-fill insulation from spilling into the living space ~~when the attic access is opened~~, from higher to lower sections of the attic, and from attics covering conditioned spaces to unconditioned spaces. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

Exception: Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of Table R402.1.2 based on the applicable climate zone specified in Chapter 3.

Reason: This section of the code is solely about the installation of insulation in the attic and retaining it in its installed location to ensure that it performs as intended by the manufacturer. The use of wooden or equivalent baffle retainer or insulation dam to hold insulation in place at the attic hatch needs to be expanded to include insulation that is installed in raised ceilings or separating conditioned from unconditioned spaces. The inclusion of additional language to this proposal improves how insulation will perform when installed in these locations.

Cost Impact: The code change proposal will increase the cost of construction. Attention to detail in installation dams and baffles will initially take slightly more labor but will be negligible once methods are in place to do it right the first time. The cost of ownership and cost of builder warranty is lowered.

RE49-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This is very good best practice and something builders should be following (Vote: 6-5).

Assembly Action:

None

RE49-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R402.2.4 (IRC N1102.2.4)

Proponents:

Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.4 (IRC N1102.2.4) Access hatch doors and insulation retention. Vertical or horizontal access doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is

installed, a wood-framed or equivalent baffle, retainer, or dam shall be installed to prevent loose-fill insulation from spilling into living space , from higher to lower sections of the attic, and from attics covering conditioned spaces to unconditioned spaces. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

Exception: Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of Table R402.1.2 based on the applicable climate zone specified in Chapter 3.

Commenter's Reason: This public comment restores the exception which is necessary in terms of practicality, clear applicability of the requirements, and to ensure the intent of the provisions are met. While the proposed amended language may help ensure that best practices are followed in some cases (though the committee was clearly divided in their decision that this amendment is needed), it creates ambiguity with respect to vertical doors by calling them "access hatch doors" in the title and then only "access doors" in the provision, and more importantly, no longer allows the use of a standard vertical door to open to a stairway leading to, or directly into an unconditioned attic space if it meets the IECC requirements for exterior entry doors. The exception makes clear this is not the intent of the Section R402.2.4 and it needs to be maintained. In addition, as amended, Section R402.2.4 could be interpreted as applying only to "hatch" doors, and that a standard door opening to a stairway or directly into an unconditioned attic space does not need to meet the thermal performance requirement for exterior doors as currently required. Restoration of the exception does not change the intent of the proposal to provide best practices guidance and is absolutely necessary for the reasons stated above.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This will decrease the cost of construction by not requiring standard size entry doors to be insulated to the same level as surrounding surfaces.

Public Comment# 1818

RE50-19

IECC: R202 (IRC N1101.6), R402.2.5 (IRC N1102.2.5)

Proposed Change as Submitted

Proponents: Felix Zemel, representing ICC Region 6 -- North East Regional Coalition (felix@pracademicsolutions.com); Peter Zvingilas, ICC Region 6- North East Regional Coalition, Town of Groton and Voluntown CT, representing ICC Region 6- North East Regional Coalition (pzvingilas@voluntown.gov)

2018 International Energy Conservation Code

Revise as follows:

R402.2.5 (IRC N1102.2.5) Mass walls. Mass walls where used as a component of the *building thermal envelope* shall be one of the following:

1. Above-ground walls of concrete block, concrete, insulated concrete form, masonry cavity, brick but not brick veneer, adobe, compressed earth block, rammed earth, solid timber, mass timber, or solid logs.
2. Any wall having a heat capacity greater than or equal to 6 Btu/ft² ● °F (123 kJ/m² ● K).

Add new definition as follows:

MASS TIMBER Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction, as defined in the *International Building Code*

Reason: This new term, as approved in the 2018 Group A Code Hearings for the IBC, adds a new type of construction into the residential provisions of the IECC. By adding this definition, the subsequent definitions of mass walls can be updated to include mass walls. Addition of mass timber into the prescriptive list of materials that are considered mass walls will make it possible for any material meeting the IBC definition of mass timber to be used without additional testing for heat capacity.

Cost Impact: The code change proposal will decrease the cost of construction. By adding mass timber into the prescriptive list of materials constituting a mass wall, builders will be able to use mass timber for building envelope features without requiring additional testing for heat capacity of the material. By saving on this testing, the cost of construction is expected to decrease.

RE50-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Although the committee really like concept of the proposal, they would like to see more information on heat capacity of these systems (Vote 11-0).

Assembly Action: **None**

RE50-19

Individual Consideration Agenda

Public Comment 1:

IECC@: 202 (New)

Proponents:

Loren Ross, representing American Wood Council (lross@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**MASS TIMBER** Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction, as defined in the *International Building Code*~~

Commenter's Reason: The modification to the original proposal is to delete the definition of mass timber so that the definition in the IBC will be used. This change prevents duplication and possible confusion.

Committee disapproval was because of lack of information on the heat capacity of mass timber, not for lack of merit of the proposal. This comment provides the information asked for by the committee.

The technical requirements for lightweight mass assemblies are in the commercial provisions of the IECC (C402.2.2) and ASHRAE 90.1. Both state that walls can be considered mass if they "have a heat capacity exceeding 5 Btu/ft² °F where the material weight is not more than 120 pcf." The following calculations demonstrate that typical mass timber walls and floors meet this requirement.

The heat capacity of mass timber is dominated by the wood. The Wood Handbook¹ states that the heat capacity is "practically independent of density or species," and gives equation 4-17, which calculates the heat capacity based upon moisture content and temperature. Using a temperature of 75 °F and a moisture content of 12%, the heat capacity is calculated as 0.393 Btu/lb °F. This calculated value for wood corresponds well with tested values for CLT (KLH rates its CLT at 0.382 Btu/lb °F). The closeness of these values show that the glue has little effect upon the heat capacity.

The temperature of 75 degrees is given in 16 CFR Part 460, which regulates R-values for home insulation (<https://www.ftc.gov/policy/federal-register-notice/16-cfr-part-460-labeling-advertising-home-insulation-trade-0>).

A moisture content of 12% is the average given in PRG 320: Standard for Performance-Rated Cross-Laminated Timber. Cross-Laminated Timber (CLT) is a type of mass timber.

Unit conversion is needed for comparison with the requirements in the IECC and ASHRAE 90.1, so a density and wall thickness need to be assumed. PRG 320 says that the minimum specific gravity of wood used shall be 0.35. Typical lumber species used in CLT manufacture range in specific gravity from 0.35-0.55. Denser wood will give a higher heat capacity. Per the Wood Handbook, the density of wood with a specific gravity of 0.35 and a moisture content of 12% is 24.0 lb/ft³. The density of wood with a specific gravity of 0.55 at 12% moisture content is 38.4 lb/ft³.

A 5-ply CLT assembly will be assumed with a thickness given in PRG 320 as 6 7/8". A thinner assembly will likely have gypsum wallboard, which is denser and has a higher heat capacity than wood.

By combining the above assumptions with the calculated heat capacity, typical mass timber CLT walls are shown to have a heat capacity of 5.4-8.6 Btu/ft² °F, which meet the requirement of the IECC and ASHRAE 90.1.

For floors, ASHRAE 90.1 has the same minimum heat capacity requirement as walls, so no further calculation is necessary, but the commercial IECC also requires a minimum weight of 25 psf where the material weight is 120 pcf or less. This requirement can be easily met by adding a concrete or gypcrete topping to the mass timber floor panel, which is common practice. Using the minimum CLT density and the same thickness as above, and assuming lightweight concrete topping of 90 pcf, 1.5 inches of concrete will meet the minimum weight requirement. Heavier concrete, denser wood species, or a thicker CLT panel will reduce the thickness of concrete topping needed to meet the weight requirement.

Bibliography: ¹Forest Products Laboratory. Wood handbook - Wood as an engineering material. General Technical Report FPL-GTR-190. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 4-12 p. 2010 https://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr190.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This public comment only deletes (from the proposal) a definition that is currently available in the IBC. This is a simple clarification and clarifications to code language have no cost impact. However, as stated in the proposal, recognition of mass timber provides another option and more options tend to lower the cost of construction.

Public Comment# 1817

RE51-19

IECC: TABLE R402.2.5 (IRC N1102.2.6)

Proposed Change as Submitted

Proponents: Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.2.6 (IRC N1102.2.6)
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION R-VALUES**

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL-FRAME EQUIVALENT R-VALUE^a
Steel Truss Ceilings ^b	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings ^b	
R-30	R-38 in 2 × 4 or 2 × 6 or 2 × 8 R-49 in any framing
R-38	R-49 in 2 × 4 or 2 × 6 or 2 × 8 or 2 × 10
Steel-Framed Wall, 16 inches on center	
R-13	R-13 + 4.2 or R-21 + 2.8 or R-0 + 9.3 or R-15 + 3.8 or R-21 + 3.1
R-13 + 3	R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 or R-19 + 5.0 or R-21 + 4.7
<u>R-13+5</u>	<u>R-0+15 or R-13+9 or R-15+8.5 or R-19+8 or R-21+7</u>
<u>R-13+10</u>	<u>R-0+20 or R-13+15 or R-15+14 or R-19+13 or R-21+13</u>
R-20	R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 or R-19 + 6.2 or R-21 + 7.5
R-20 + 5	R-13 + 12.7 or R-15 + 12.3 or R-19 + 11.6 or R-21 + 11.3 or R-25 + 10.9
R-21	R-0 + 14.6 or R-13 + 9.5 or R-15 + 9.1 or R-19 + 8.4 or R-21 + 8.1 or R-25 + 7.7
Steel Framed Wall, 24 inches on center	
R-13	R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
R-13 + 3	R-0 + 11.2 or R-13 + 4.9 or R-15 + 4.3 or R-19 + 3.5 or R-21 + 3.1
<u>R-13+5</u>	<u>R-0+15 or R-13+7.5 or R-15+7 or R-19+6 or R-21+6</u>
<u>R-13+10</u>	<u>R-0+20 or R-13+13 or R-15+12 or R-19+11 or R-21+11</u>
R-20	R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 or R-19 + 6.3 or R-21 + 5.9
R-20 + 5	R-13 + 11.5 or R-15 + 10.9 or R-19 + 10.1 or R-21 + 9.7 or R-25 + 9.1
R-21	R-0 + 14.6 or R-13 + 8.3 or R-15 + 7.7 or R-19 + 6.9 or R-21 + 6.5 or R-25 + 5.9
Steel Joist Floor	
R-13	R-19 in 2 × 6, or R-19 + 6 in 2 × 8 or 2 × 10
R-19	R-19 + 6 in 2 × 6, or R-19 + 12 in 2 × 8 or 2 × 10

- a. The first value is cavity insulation *R*-value, the second value is continuous insulation *R*-value. Therefore, for example, “R-30+3” means R-30 cavity insulation plus R-3 continuous insulation.
- b. Insulation exceeding the height of the framing shall cover the framing.

Reason: Commenter’s Reason: This proposal expands the listing for cold-formed steel equivalent R-values in order to coordinate with Tables R402.1.2 and N1102.1.2 entitled “Insulation and Fenestration Requirements by Component”.

History and Selection of Methodology: The RESCheck methodology was originally selected for determining equivalency since its methodology for calculating wood and steel framed U-factors has served as the basis for U-factor calculations of these assemblies since the publication of the 2004 IECC Supplement Edition. This approach was again used for consistency in this code change proposal.

Details of Calculations and Assumptions: The U-factors from Tables R402.1.4 (and N1102.1.4) for wood framed walls were used as the benchmark to determine the equivalent insulation (Cavity and continuous) R-values for cold-formed steel framing. The cold-formed steel framed walls at 16” o.c. and 24” o.c. were then calculated where cavity and exterior insulation were added in order to achieve near equivalent U-factors as for wood framed wall assemblies. This resulted in R-values and U-factors for cold-formed steel framed walls that can be considered comparable to wood wall assemblies.

In addition to the above modification, we are also proposing the deletion of the R-19+6.2 assembly configuration for the Wood 16 O/C category R-20. After a re-analysis we found that the U-factor is higher than the wood assembly U-factor comparison sufficient enough to recommend its departure.

Conclusion: Adopting the proposed modifications is intended to provide related prescriptive for cold-formed steel framed assembly options consistent with the options listed for wood framed assemblies in the opaque thermal envelope tables.

Bibliography: Bartlett, R., Connell, L.M., Gowri, K., Lucas, R.G., Schultz, R.W., Taylor, Z.T., Wilberg, J.D., “Methodology for Developing the

REScheck Software through Version 4.4.3", U.S. Department of Energy, Washington, DC, contracted through the Pacific Northwest National Laboratory, Richland, WA, September 2012.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

RE51-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The change provides synchronization with other tables, per the proponents reason statement (Vote: 11-0).

Assembly Action: **None**

RE51-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.2.6 (IRC N1102.2.6) (New)

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.2.6 (IRC N1102.2.6)
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION R-VALUES**

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL-FRAME EQUIVALENT R-VALUE^a
Steel Truss Ceilings ^b	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings ^b	
R-30	R-38 in 2 x 4 or 2 x 6 or 2 x 8 R-49 in any framing
R-38	R-49 in 2 x 4 or 2 x 6 or 2 x 8 or 2 x 10
Steel-Framed Wall, 16 inches on center	
R-13	R-13 + 4.2 or R-21 + 2.8 or R-0 + 9.3 or R-15 + 3.8 or R-21 + 3.1
R-13 + 3	R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 or R-19 + 5.0 or R-21 + 4.7
R-13+5	R-0+15 or R-13+9 or R-15+8.5 or R-19+8 or R-21+7
R-13+10	R-0+20 or R-13+15 or R-15+14 or R-19+13 or R-21+13
R-20	R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 or R-21 + 7.5
R-20 + 5	R-13 + 12.7 or R-15 + 12.3 or R-19 + 11.6 or R-21 + 11.3 or R-25 + 10.9
R-21	R-0 + 14.6 or R-13 + 9.5 or R-15 + 9.1 or R-19 + 8.4 or R-21 + 8.1 or R-25 + 7.7
Steel Framed Wall, 24 inches on center	
R-13	R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
R-13 + 3	R-0 + 11.2 or R-13 + 4.9 or R-15 + 4.3 or R-19 + 3.5 or R-21 + 3.1
R-13+5	R-0+15 or R-13+7.5 or R-15+7 or R-19+6 or R-21+6
R-13+10	R-0+20 or R-13+13 or R-15+12 or R-19+11 or R-21+11
R-20	R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 or R-19 + 6.3 or R-21 + 5.9
R-20 + 5	R-13 + 11.5 or R-15 + 10.9 or R-19 + 10.1 or R-21 + 9.7 or R-25 + 9.1
R-21	R-0 + 14.6 or R-13 + 8.3 or R-15 + 7.7 or R-19 + 6.9 or R-21 + 6.5 or R-25 + 5.9
Steel Joist Floor	
R-13	R-19 in 2 x 6, or R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6, or R-19 + 12 in 2 x 8 or 2 x 10

a. The first value is cavity insulation *R*-value, the second value is continuous insulation *R*-value. Therefore, for example, "R-30+3" means R-30 cavity insulation plus R-3 continuous insulation.

b. Insulation exceeding the height of the framing shall cover the framing.

Commenter's Reason: This public comment further coordinates the steel table with Tables R402.1.2, and related IRC Table N102.1.2, by removing the "R-13+3" requirement since this component option is no longer shown in the residential R-value tables.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Removing a component category will not increase or decrease the cost of construction since the category no longer exists in the primary R-value residential tables.

RE54-19

IECC: R402.2.9 (IRC N1102.2.9)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.9 (IRC N1102.2.9) Basement walls. Walls associated with conditioned basements shall be insulated from the top of the ~~basement wall~~ down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. ~~Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.~~ comply with the following requirements:

1. Basement walls that define the *building thermal envelope* shall be insulated. The R-value shall be in accordance with the compliance path that is defined at the time of obtaining the building permit. Unconditioned basements shall comply with the floor insulation requirements of Section R402.2.8.
2. Unfinished basement walls that define the *building thermal envelope* shall have insulation that is permanently fastened to the wall. The insulation shall cover the exposed portion of the top of the foundation wall not covered by the sill plate, and extend downward to the finished floor below.
3. Finished basement walls that define the *building thermal envelope* shall be insulated with material that fully fills the framed stud cavity of the finished wall or material that upon installation fully fills the available space. A 1 in. (25 mm) gap is allowed between the framed cavity and insulation, and the concrete foundation wall. Insulation shall be installed between framed bottom plates and the foundation floor when floating walls are used. Insulation shall be installed at the top of the foundation wall not covered by the sill plate.

Reason: This section of the code defines required installation requirements of the code that are not defined by manufacturer instructions. Since the section does not define R-value requirements requirement #1 defines that the R-value installed needs to be in accordance with the compliance path that is used. Requirement #2 is specific to installation requirements for unfinished basement walls and requirement #3 is specific to installation requirements for finished basement walls. All requirements ensure that if the basement wall defines the *building thermal envelope* it is completely insulated and that there are no thermal bypasses allowed in the installation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact associated with this code proposal as it only clarifies the existing installation requirements of the code that are not adequately defined in the current section of the code

RE54-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This proposal makes things more complicated (Vote: 10-1).

Assembly Action:

None

RE54-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.9 (IRC N1102.2.9)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.9 (IRC N1102.2.9) Basement walls. Walls associated with conditioned basements shall be insulated ~~from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8. on the exterior or the interior side and comply with the following: requirement:~~

1. ~~Basement walls that define the building thermal envelope shall be insulated. The installed insulation~~ R-value shall be in accordance with the compliance path that is defined at the time of obtaining the building permit. Unconditioned basements shall comply with the floor insulation requirements of Section R402.2.8.
2. Exterior basement wall insulation shall be permanently fastened to the wall and extend downward from the sill plate to the footing. Unfinished basement walls that define the building thermal envelope shall have insulation that is permanently fastened to the wall. The insulation shall cover the exposed portion of the top of the foundation wall not covered by the sill plate, and extend downward to the finished floor below.
3. Interior basement wall insulation shall extend downward from the interior edge of the sill plate to the finished floor below. Finished basement walls that define the building thermal envelope shall be insulated with material that fully fills the framed stud cavity of the finished wall or material that upon installation fully fills the available space. A 1 in. (25 mm) gap is allowed between the framed cavity and insulation, and the concrete foundation wall. Insulation shall be installed between framed bottom plates and the foundation floor when floating walls are used. Insulation shall be installed at the top of the foundation wall not covered by the sill plate.

Commenter's Reason: The committee felt this proposal made things more complicated. Therefore, it has been significantly simplified. The Public comment ensures that insulation R-value is installed per the compliance path chosen. That insulation is installed properly from either the exterior or the interior side of the foundation wall which addresses and resolves past consistent thermal bypass issues. Lastly, Provisions for ensuring the required R-value of the installed material have been maintained, as well as when an unconditioned basement is built.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost impact associated with this code proposal as it only clarifies the existing installation requirements of the code that are not adequately defined in the current section.

Public Comment# 1890

RE57-19

IECC: R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Aaron Gary, representing Self (aaron.gary@texenergy.org)

2018 International Energy Conservation Code

Revise as follows:

R402.4.1.1 (IRC N1102.4.1.1) Installation. The components of the *building thermal envelope* as indicated in Table R402.4.1.1 shall be installed in accordance with Grade I as defined by RESNET/ICC 301 Appendix A, the manufacturer's instructions and the criteria indicated in Table R402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

Reason: Unlike the ERI path, the Prescriptive and Performance path assume that envelope insulation is always installed as intended. Pointing only to the manufacturer's instructions however makes this very hard to manage for contractors and code officials as there is no central repository of manufacturer's instructions for them to easily reference nor do they usually have time to read more than what is clearly and simply stated in the Code. Supplementing the manufacturer's installation instructions with something that is easy for all involved to reference and developed for ICC 700 (an ANSI approved standard that many of the insulation manufacturer's contributed to) would greatly increase the ease of use of the Code. Usable and understandable Code would lead to better installations and enforcement. The end result then would not be predicted savings (as models already assumes a near perfection which is rarely achieved in real life) but actual energy savings to the end user, i.e. the home owner or apartment dweller.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
If the manufacturer's instructions are already being met, then this code proposal will not increase or decrease the cost of construction.

RE57-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The Appendix is not ready, and there is potential conflict between Grade I and manufacturers installation when both are required (Vote 8-3).

Assembly Action:

None

RE57-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Submitted

Commenter's Reason: The installation of the insulation should be installed to a grade 1 installation. Any other building component of the building would not allow for the other building components to be installed hap hazard as insulation is installed. No one would allow for roofing shingles to be installed with large bumps or upside down or crumbled up, so why do we allow for the insulation to be installed in this fashion.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Actually by installing the insulation correctly it may decrease the cost by additional or replacement materials not required, and the additional manpower for the correction of installation, and time waiting for additional inspections.

Public Comment# 1763

Public Comment 2:

Proponents:

Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests Disapprove

Commenter's Reason: As the committee stated on RE57 and noted again on RE14, RESNET's new appendix on grade 1 insulation is not ready. Installing insulation correctly is important, but the significantly changed grade 1 insulation requirements will do more harm than good. A partial list of the problems with RESNET's 301 grade 1 appendix follows. In all cases the problems cite examples of specific text from the new RESNET 301 Grade 1. Most of the problems fall into one of these groups:

-eliminates reasonable construction techniques and/or products

-mixes up "recommendations" and "instructions"

-has incomplete or unusable references as requirements

Bold below is added. All section titles and numbers are from RESNET's new 301 appendix. "Comments" below briefly state the problem.

Eliminates reasonable construction techniques or products:

*A-1.1 Minimum General Installation Requirements ... PART 2 - **No air spaces** shall be allowed between different insulation types or systems.* - Comment - Sometimes **air spaces are needed** for drainage and moisture redistribution. For example foil faced insulation over spray foamed wall cavity without an air space would be a problem. Stucco rot and some EIFS problems are partly a result of a lack of air spaces.

A-1.2 Minimum Specific Application Requirements 1. ...The combination of both cavity and continuous insulation shall meet or exceed the minimum required floor R value in Table 402.1.2 of the International Energy Conservation Code, (IECC).... - Comment - RESNET's criteria says floor insulation cannot be Grade 1 unless the R-value meets or exceeds 2018 IECC Table 402.1.2? Why? Why just the floors? RESNET is mixing up R-value with quality of the installation.

*3. ... The effective air barrier shall extend up and beyond the surface of the insulation **or to the ridge vent.*** - Comment - This is a problem for cathedral ceilings. Baffles are not air barriers.

*A-2.2 Structural Insulated Panels (SIPs) Grading Criteria ... 2. **Use spray foam to seal** penetrations through the SIP panels. ... 4. All gaps and penetrations through SIPs including windows, doors, and foundation or roof connections shall be **air-sealed with expanding foam** compatible with the SIP materials.* - Comment - Why only expanding foam for air sealing? What about mastics, tapes and caulking?

*A-2.3.2 Attic Radiant Barriers Minimum Requirements ... 3. Attic and/or roof **ventilation shall be maintained.** Roof, gable and soffit vents shall not be covered.* - Comment - What about unvented attics? Does this eliminate unvented attics in the IRC?

Comment- RESNET exempts fiberglass in basement and crawl spaces from air barriers if there is an interior air barrier (Appendix Section A1.3.2, #2 item "d"). This fiberglass exemption is fine. However, cellulose should also have the exemption as cellulose is denser than fiberglass and cellulose would do an even better job of inhibiting convection within the insulation.

Mixes up "recommendations" and "instructions":

*A-1.1 Minimum General Installation Requirements PART 1 - Insulation shall be installed to manufacturers' **recommendations.*** - Comment - code uses "instructions". "Instructions" and "recommendations" can be very different. Can insulation be grade 1 without following the manufacturer's instructions? Manufacturers and the code expect instructions to be followed. The code does not require or even refer to manufacturer's recommendations. From the IRC: "Section R302. Installation. Materials, systems and equipment shall be installed in accordance with the **manufacturer's instructions** and the IBC or IRC as applicable."

Has incomplete or unusable references as requirements and does not follow CP-28 guidelines:

*A-1.3.4 Open-Cell Spray Polyurethane Foam (SPF) Insulation 1. Installers shall meet the manufacturer's recommended training requirements and shall complete **the online health and safety training for SPF provided by the Center for Polyurethanes Industry.*** - Comment - This is an undated reference to an unknown web address and does not name the "document". Likely the "document" was not subject to ANSI or code compliant development process.

*A-1.3.6 Closed-Cell Spray Polyurethane Foam (SPF) Insulation ... Installers shall meet the manufacturer's recommended training requirements and shall complete **the online health and safety training for SPF provided by the Center for Polyurethanes Industry.*** - Comment - Again an

undated reference to an unknown web address. It does not name the “document”. Likely the “document” was not subject to ANSI or code compliant development process.

A-2.2 Structural Insulated Panels (SIPs) Grading Criteria 1. Sealing of panel joints shall meet the manufacturer's requirements. Where the manufacturer does not have specific joint sealing details SIPA's typical joint sealing details shall be used. SIPA details are available at www.sips.org. -Comment - Another undated reference to an unknown web address. Again it does not name the “documents”. Likely the “documents” were not subject to ANSI or code compliant development process.

*A-2.3 Reflective/Radiant Grading Criteria ... 3. Where utilizing R-Values based on testing in accordance with ASTM C1224, the reflective insulation product shall be installed as tested. R-Value claims for the assembly including the airspace shall be based on ASTM C1224 or per the **current FTC Rule 460** requirements.* - Comment - It is impropriate to reference the “current” version of something. FTC rules are not consensus documents. No section of the FTC rule is referenced.

RESNET'S new grade 1 insulation requirements are not ready and should not be required by code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code if this disapproval stands.

Public Comment# 2094

RE59-19

IECC: R402.2.9 (IRC N1102.2.9) (New), R402.2.9 (IRC N1102.2.9)

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.2.9 (IRC N1102.2.9) Basement Walls Basement walls shall be insulated in accordance with Table R402.1.2.

Exception: Basement walls associated with unconditioned basements where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.

Revise as follows:

~~**R402.2.9 (IRC N1102.2.9) R402.2.9.1 (IRC N1102.2.9.1) Basement walls insulation installation (Mandatory).** Walls associated with conditioned basements. Where basement walls are insulated, the insulation shall be insulated installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.~~

Reason: R402.2.9 includes both prescriptive provisions (required insulation levels) and non-tradeable (mandatory) installation specifications. This proposal does not add new requirements; rather, it separates the prescriptive and mandatory provisions into separate sections.

The insulation installation requirements of new Sec. R402.2.9.1 have no value or metric that can be used for modeling purposes; they are non-tradeable (mandatory).

Note that the SEHPCAC has a proposal to eliminate the use of the labels "prescriptive" and "mandatory" in favor of a tabular method of identifying non-tradeable requirements. If that proposal is successful, ICC staff have stated that sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new C407.2 table of requirements that are non-tradeable in the performance path.

This proposal is submitted by the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at: <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx> (<http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>)

Cost Impact: The code change proposal will increase the cost of construction. The code change may increase construction costs for a subset of buildings that may have been designed using the Total Building Performance or EIR compliance methods that did not follow the basement wall insulation installations provisions contained in this section.

RE59-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R402.2.9.1 (IRC N1102.2.9.1) Basement walls insulation installation (Mandatory). Where basement walls are insulated, the insulation shall be installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less.

Committee Reason: It adds clarity and allows for adjustments in installation. The modification added clarity (Vote: 9-2).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.9 (IRC N1102.2.9) (New), R402.2.9.1 (IRC N1102.2.9.1)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R402.2.9 (IRC N1102.2.9) Basement Walls [Prescriptive]. Basement walls shall be insulated in accordance with Table R402.1.2. The insulation shall extend the distance from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less.

Exception: Basement walls associated with unconditioned basements where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.

R402.2.9.1 (IRC N1102.2.9.1) Basement walls insulation installation [Mandatory]. Where basement walls are insulated, the insulation shall be installed from the top of the *basement wall* down in accordance with Section R402.2.9 or the distance of the proposed design as applicable to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Continuous insulation shall be installed on the interior or exterior side of the basement wall. Cavity insulation shall be installed on the interior side of the basement wall.

Commenter's Reason: RE 59-19 was recommended for approval as modified by the committee. The modification made at the committee action hearing removed the "mandatory" designation from the installation requirements in proposed Section R402.2.9.1 due to concern with some of the content being prescriptive (such as the 10ft distance downward from top of basement wall). That modification, however, did not resolve the fact that some of the installation requirements are mandatory such as starting the basement wall insulation at the top of the wall, even if the distance downward is modified by an alternative solution (i.e., proposed design). This public comment maintains the intent of the original proposal and improves it by revising and cleaning-up the text such that the prescriptive and mandatory requirements are clearly differentiated while also allowing alternative installation solutions. It also includes basic installation requirements for continuous and cavity insulation that are otherwise buried in footnote 'c' of Table R402.1.2. For these reasons, we request your support for approval as further modified by this PC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. With this public comment, the issues with the original proposal not allowing alternative installation through the total building performance or ERI path is resolved such that there should be no cost impact as the PC makes it clear that alternative installation practices can still be used based on performance via a proposed design. Thus, the installation practices (whether by performance or by compliance with the R-value method) can be considered mandatory as they should be to ensure the intended performance is achieved.

Public Comment# 1752

RE60-19

IECC@: R402.2.10 (IRC N1102.2.10), R402.2.10.1 (IRC N1102.2.10.1) (New)

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.10 (IRC N1102.2.10) Slab-on-grade floors. Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2. ~~The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall.~~

Exception: Slab-edge insulation is not required in jurisdictions designated by the *code official* as having a very heavy termite infestation.

Add new text as follows:

R402.2.10.1 (IRC N1102.2.10.1) Slab-on-grade floor insulation installation (Mandatory) Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall.

Reason: R402.2.10 includes both prescriptive provisions (insulation levels) and non-tradeable (mandatory) installation specifications, plus an embedded exception for termite infestations.

This proposal does not add new requirements; rather, it separates the prescriptive and mandatory provisions into separate sections and clarifies the exception to required insulation in jurisdictions designated by the code official as having a very heavy termite infestation.

The insulation installation requirements of new Sec. R402.2.10.1 have no value or metric that can be used for modeling purposes; they are non-tradeable (mandatory).

Note that the SEHPCAC has a proposal to eliminate the use of the labels "prescriptive" and "mandatory" in favor of a tabular method of identifying non-tradeable requirements. If that proposal is successful, ICC staff have stated that sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new C407.2 table of requirements that are non-tradeable in the performance path.

This proposal is submitted by the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at: <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx> (<http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>)

Cost Impact: The code change proposal will increase the cost of construction

The code change may increase construction costs for a subset of buildings that may have been designed using the Total Building Performance or EIR compliance methods that included slab on grade with insulation installed not in accordance with the provisions of this section.

RE60-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are some complications in how the proposal is written and confusion about what is mandatory (Vote: 6-5).

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

Individual Consideration Agenda

Public Comment 1:

IECC@: R402.2.10.1 (IRC N1102.2.10.1) (New)

Proponents:

David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.10.1 (IRC N1102.2.10.1) Slab-on-grade floor insulation installation (Mandatory) Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the *building*. Insulation extending away from the *building* shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*.

Commenter's Reason: Testimony at the committee action hearings revealed that some builders model different insulation installation details which affect prescriptive requirements, making this section 'tradeable.'

In keeping with SEHPCAC's goal of clarifying the distinction between tradeable (prescriptive) and non-tradeable (mandatory) sections, and because these provisions are being 'traded,' this proposal should not be labeled 'mandatory.'

Note that the commercial energy hearing committee acted on the parallel section in the commercial code to also make these provisions 'prescriptive,' for the following reason: *"The proposal provides needed clean up, it is tradable, the modification gives needed flexibility (Vote: 15-0)."*

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Eliminating the "mandatory" language in this code section, as proposed in this public comment, nullifies the potential to increase construction costs for a subset of buildings that may have been designed using the Total Building Performance or EIR compliance methods that included slab on grade with insulation installed not in accordance with the provisions of this section.

Public Comment# 1718

Public Comment 2:

IECC@: R402.2.10 (IRC N1102.2.10), R402.2.10.1 (IRC N1102.2.10.1) (New)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.10 (IRC N1102.2.10) Slab-on-grade floors [Prescriptive]. Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2.

Exception: Slab-edge insulation is not required in jurisdictions designated by the *code official* as having a very heavy termite infestation.

R402.2.10.1 (IRC N1102.2.10.1) Slab-on-grade floor insulation installation (Mandatory) Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2, or the distance of the proposed design as applicable, by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the *building*. Insulation extending away from the *building* shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*.

Commenter's Reason: This public comment addresses the committee's reasons for narrowly (6-5) recommending disapproval by clarifying the complications and confusion related to mandatory aspects of slab-on-grade floor insulation installation requirements. The key concern is that different insulation distances from the top of slab are possible if properly addressed by a proposed design. Otherwise, basic installation practices should be considered mandatory to ensure the intended performance, whether by way of the prescriptive R-value method or by way of one of the performance paths for compliance. This PC makes this distinction clear. Your approval as modified is requested.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. With this public comment, the issues with the original proposal not allowing alternative installation through the total building performance or ERI path is resolved such that there should be no cost impact as the PC makes it clear that alternative installation practices can still be used based on performance via a proposed design. Thus, the installation practices (whether by performance or by compliance with the R-value method) can be considered mandatory as they should be to ensure the intended performance is achieved.

Public Comment# 1754

RE61-19

IECC: R402.2.11 (IRC N1102.2.11)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.11 (IRC N1102.2.11) Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be insulated provided that the crawl space is not vented to the outdoors. Crawl space wall insulation shall be permanently fastened to the wall and shall extend downward from the ~~floor to the finished grade elevation and then vertically or horizontally for not less than an additional 24 inches (610 mm)~~ sill plate on top of the crawlspace wall to the floor of the crawlspace. Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder in accordance with the International Building Code or International Residential Code , as applicable. Joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (153 mm) up stem walls and shall be attached and sealed to the stem walls.

Reason: The foundation of an unvented conditioned crawlspace must be insulated to have a continuous building thermal envelope. It is less clear if the floor of the crawlspace needs to be insulated. However, what is known is that the extension of the wall insulation 24" horizontally over the dirt or vapor retarder on the dirt floor inside the crawlspace is not being enforced with any regularity. When using the Ekotrope or REMRate modeling software to demonstrate compliance with the cost compliance report used in Section R405 it is easy to demonstrate no value associated with the 24" of extended insulation. The crawlspace dirt floor is 3-5 feet below grade and it is not required to be insulated fully. Similarly, there is no requirement to insulate the concrete floor in a basement that is eight feet below grade. If there were a requirement there would be countless arguments regarding the cost-effectiveness of the insulation. This proposal aims to take the 24" extension of insulation out of the code in order to fully focus on insulating the portion of the foundation that is associated with the majority of the heat loss or gain. On the other side of the equation, when portions of concrete foundation walls are not insulated such as the top of the foundation adjacent to the sill plate it is easy to demonstrate value for the installation of insulation. IR camera imaging, as well as Ekotrope and REMRate modeling, can demonstrate the impact of small portions of uninsulated building thermal envelope.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Would be cost saving associated with this proposal as the 24" extension of insulation over the floor of the crawlspace would be removed as a requirement from the code while asking for a small portion of insulation to be installed at the top of the foundation wall.

RE61-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The new language does not add clarity and may result in unintended thermal bridging consequences (Vote: 7-4).

Assembly Action:

None

RE61-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R402.2.11 (IRC N1102.2.11)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.11 (IRC N1102.2.11) Crawl spaces walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be insulated on the exterior or interior side, provided that the crawl space is not vented to the outdoors, in which case the insulation shall follow Section R402.2.8:

1. Exterior crawl space wall insulation shall be permanently fastened to the wall and extend downward from the sill plate to the footing.
2. Interior crawl space wall insulation shall be permanently fastened to the wall and extend downward from the sill plate on top of the crawl space wall to the interior floor of the crawl space.

~~Crawl space wall insulation shall be permanently fastened to the wall and shall extend downward from the sill plate on top of the crawlspace wall to the floor of the crawlspace.~~

Crawl spaces vented to the outdoors shall comply with Section R402.2.8.

Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder in accordance with the International Building Code or International Residential Code , as applicable. Joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (153 mm) up stem walls and shall be attached and sealed to the stem walls.

Commenter's Reason: Public Comment Reason Statement

When the committee stated that the language in my original proposal did not add clarity and may result in unintended thermal bridging consequences, I realized that the existing installation instructions only work when insulation is installed on the exterior, as the installation describes a frost-protected foundation insulation installation. When you install insulation on the inside of the foundation wall, it is important to remember to insulate the top of the foundation wall that is not covered by the sill plate, but it does not make sense to extend the insulation in 2 feet. In fact, I have only seen it installed that way once, and most jurisdictions do not enforce the installation. It does make sense to extend the insulation out from the foundation to get frost protection and protect the footing. This appears to be the rationale of the current language. Therefore, I have broken up the installation into exterior and interior installation instructions to address the committee's comments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction I don't think that there would be added cost in the construction of a crawl space foundation as the current insulation installation options are still allowed. However, there could be a cost-saving associated with this proposal as the 24" extension of insulation over the floor of the crawlspace has been removed as a requirement from the code in exchange for asking for a small portion of insulation to be installed at the top of the foundation wall.

Public Comment# 1880

RE63-19

IECC@: R402.2.14 (IRC N1102.2.14) (New)

Proposed Change as Submitted

Proponents: John Woestman, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace is located on the interior side of the continuous air-barrier and is bounded on all sides by building components.

Exception: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

Reason: This proposal is identical to requirements for airspaces added to the 2018 IECC-C (Section 402.2.7). It also is consistent with ASHRAE 90.1-2016 (Section A9.4.2) which was the basis for IECC-C Section 402.2.7. These provisions will ensure that the R-value of airspaces are properly accounted for when used as an optional means of energy code compliance.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal provides needed requirements for the additional and optional use of airspaces as a supplemental means of energy code compliance. This proposal may add an option that's currently not in the code.

RE63-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are questions about the cost statement and enforcability of air flow and air rate (Vote: 11-0).

Assembly Action:

None

RE63-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R402.2.14 (IRC N1102.2.14) (New)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace is located on the interior side of the continuous air-barrier and is bounded on all sides by building components.

Exception: ~~The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.~~

Commenter's Reason: The committee reason for recommending disapproval was (1) "questions about the cost statement" and (2) "enforceability of air flow and air rate". This public comment addresses both concerns by clarifying the cost impact and deleting the exception statement.

First, the cost statement is accurate in that the existing code does not provide guidance for proper application of air spaces in building envelopes for purpose of meeting R-value or U-factor requirements. Thus, by adding this proposed provision, it will provide greater assurance that air spaces, when properly constructed or tested, can be used to contribute to an assembly's thermal performance. Consequently, this will not increase construction cost and in some cases may actually reduce it. Hence, the proponent appropriately indicated that the proposal "will not increase or decrease construction cost" and provided a rational explanation.

The second part of the committee statement was dealing with "enforceability" of the exception statement. The exception statement, although deleted in this PC, is currently in the IECC-C and was included in the original proposal to make the IECC-R exactly consistent with the IECC-C. This exception is enforceable and is not different from similar provisions already in the I-codes that reference a test method and then test criteria which a qualified test lab complies with in forming a test report for code compliance purposes. However, this public comment removes the originally proposed exception statement because it is a non-mandatory optional means of compliance and is not necessary in the IECC-R prescriptive provisions. This removes any concern with enforceability of the exception statement and its referenced performance test method and air-flow rate.

With the changes made in this PC to address the committee comments, your approval as modified is requested.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The application of air spaces for compliance with the thermal performance requirements of the code is not currently addressed in the code. Thus, the proposal provides an additional means of compliance or supplementing compliance with properly constructed air spaces. Without the exception statement, however, non-compliant airspaces can still be considered (as they currently are) through IECC-R Section R102. Thus, the proposal as modified by this PC may at worst have no cost impact and at best provide a means to slightly reduce cost.

Public Comment# 1624

Public Comment 2:

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proponents:

Amanda Hickman, representing Reflective Insulation Manufacturers Association International (amanda@thehickmangroup.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace ~~is located on the interior side of the continuous air barrier and~~ is bounded on all sides by building components.

Exception: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material that are ventilated and permit air flow into and out of the enclosed air space shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

Commenter's Reason: This original language does not clearly differentiate between a "ventilated and enclosed airspace" and an "unventilated and enclosed air space". ASTM C1363 explicitly prohibits the introduction of air flow into a C1363 testing apparatus: Paragraph 1.14 "This test method does not permit intentional mass transfer of air or moisture through the specimen during measurements".

It is the intention of this public comment to clarify what the exception pertains to – whether it is ventilated or unventilated.

Additionally – if the air space is "enclosed", "unventilated" and "bounded on all sides by building components" it can be tested for thermal performance with ASTM C1363 regardless of which side of the air barrier it is located.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Because the use of airspaces is optional and not required by code there is no cost impact associated with the proposal. And because this comment only modifies the proposed language it inherently does not have a cost impact.

Public Comment# 1657

Public Comment 3:

IECC@: R402.2.14 (IRC N1102.2.14) (New)

Proponents:

Dr. David Yarbrough, representing Self (davidyarbrough86@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace is located on the interior side of the continuous air-barrier and is bounded on all sides by building components.

~~**Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.~~

Commenter's Reason: The use of ASTM Test C1363 with airflow through the test specimen is outside the scope of C1363. This type of test is not permitted. The following is a quotation from ASTM C1363.

Paragraph 1.14 "This test method does not permit intentional mass transfer of air or moisture through the specimen during measurements".

Note: "mass transfer" means air moving through the test specimen.

Further, the specification of a minimum rate of 70 mm/second is arbitrary and not supported by technical literature.

This subject, "the impact of air flow on thermal performance" is the subject of a current ASHRAE research project. ASHRAE 1759-TRP: "Impact of Air Flow on Thermal Performance of Airspaces Behind Cladding" (phase 1).

One of the objectives of the ASHRAE Research project is to establish the procedure for use of a C1363 type apparatus to perform thermal measurements with air flow.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The original proposal will increase the cost of construction. However, there is no cost impact with this public comment, as it deletes an exception.

Public Comment# 1663

Public Comment 4:

Proponents:

John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

requests As Submitted

Commenter's Reason: This proposal is consistent with requirements for airspaces already in the IECC-C provisions and is justified for reasons given in the original proposal. Those same IECC-C requirements are also relevant to and no less important to appropriate treatment of airspaces in the IECC-R. These provisions only apply to airspaces that are used for the purpose of determining compliance with the energy code (e.g., an R-value is attributed to the airspace). Thus, where used for this purpose, the code should provide guidance as it has done in the IECC-C provisions.

The committee reasons for disapproval contradict the reason the provisions in the exception were included in the IECC-C last code development

cycle. The concern, in the exception, was with “enforceability of air flow rates” in the test methodology – but, that test methodology applies only to airtight spaces that are not compliant with the proposed charging language of R402.2.14 (IRC N1102.2.14), with a likely result of a significant reduction of actual R-value.

The test methodology specified in the exception can be conducted and has been conducted. The test methodology and the means of achieving the required airflow rate during testing is not “enforced” by the code official as is the case for many other testing requirements in the code. Instead, the test, following the prescribed methodology with the required airflow, is executed by a qualified laboratory for product evaluation and reporting purposes. This typically results in a product evaluation report which is presented to and used by the code official to confirm compliance with the code as a common means of enforcement.

Remember, the exception in this proposal is a non-mandatory option for considering airtight spaces, for energy code compliance purposes, which do not provide an R-value consistent with the basic requirement of being enclosed in an unvented cavity which is constructed to minimize air-flow into and out of the enclosed air space.

This proposal should be approved to ensure that the IECC-R is consistent with the IECC-C in enabling the proper use of air spaces to support energy code compliance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal provides needed requirements for the additional and optional use of airtight spaces as a supplemental means of energy code compliance. This proposal adds a non-mandatory option that’s currently not in the code.

Public Comment# 1966

Public Comment 5:

Proponents:

Wesley Hall, representing Reflectix, Inc. (wes.hall@reflectixinc.com)

requests Disapprove

Commenter's Reason: The “Cost Impact” for this proposal is in error. It specifies a “new” test method for air spaces outside the air barrier. The ASTM C1363 test method is expensive and would certainly impact material costs for the system. Additionally, it only specifies one “air movement rate”, but does not indicate the assembly or supporting test data that pertains to this air movement rate. Different ventilated assemblies outside the air barrier will have different flow rates and the exception should include a test method to determine the flow rate for that specific assembly. Additionally, the cost of a second test method to determine air movement flow rate would have associated costs that would increase the material costs, for the assembly even more.

Currently, ASTM C1363 does not permit the introduction of air flow for thermal evaluation of an assembly. This is an additional issue of importance that justifies disapproval.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The original proposal will increase the cost of construction as described above. However, there is no cost impact with this public comment, as we are requesting disapproval of the proposed language.

Public Comment# 1658

RE64-19

IECC: R402.2.14 (IRC N1102.2.14) (New)

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting / ABTG, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Energy Conservation Code

Add new text as follows:

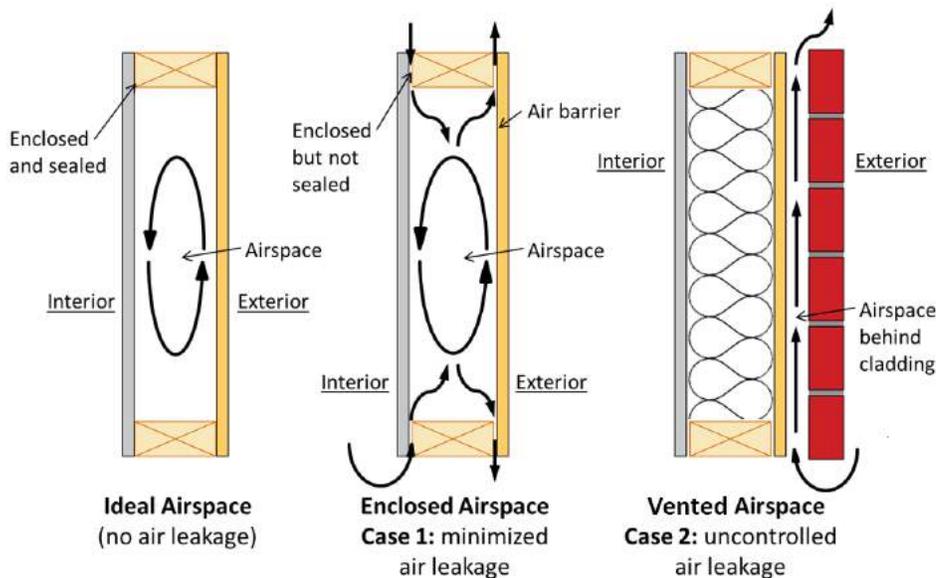
R402.2.14 (IRC N1102.2.14) Airspaces Where the R-value of an airspace is used for compliance in accordance with Section R401.2, the airspace shall be located on the interior side of the continuous air barrier and bounded on all sides by building components.

Exception: Alternative airspace conditions and means of determining R-value shall be permitted in accordance with Section C402.2.7.

Reason: This proposal coordinates the residential provisions with the prescriptive “deemed-to-comply” requirements for airspaces added to the 2018 IECC-C (Section 402.2.7). These requirements also are consistent with and based on ASHRAE 90.1-2016 (Section A9.4.2). They are applicable to both commercial and residential buildings because the thermal behavior of airspaces in assemblies doesn’t depend on building occupancy or use. Therefore, it is appropriate to consistently address airspace requirements in the IECC-R when their thermal resistance (R-value) is used as a means for compliance through the prescriptive, performance, or ERI approach of Section R401.2. An exception is provided to give flexibility for alternative airspace configurations or solutions based on the provisions (and exception) in Section C402.2.7 of the IECC-Commercial provisions.

For background on why these provisions were added to the 2018 IECC-C and also are needed in the IECC-R, the following explanation is provided. The R-values of airspaces are based on an assumption of “no air leakage” (see 2013 ASHRAE Handbook of Fundamentals, Chapter 26, Table 3, footnote b). This is illustrated in the figure below as an “ideal airspace”. As a practical matter, however, fully enclosed airspaces located to the interior of an air barrier are permitted to be considered ideal (see Case 1 in figure below). But, many airspace applications are far from “ideal” and are not fully enclosed; see Case 2 in the figure below. Air leakage into and out of an air-space due to ventilation airflow (especially if an intentionally vented airspace as common behind cladding systems) can significantly degrade its R-value, yet there is currently no standard calculation method or test method to account for this impact on an airspace R-value that otherwise is assumed to be “ideal”. This concern has been appropriately addressed in the IECC-C and, therefore, should be consistently applied to the IECC-R.

For additional information regarding performance of different air-space applications and conditions that affect R-value performance, refer to the figure below, a powerpoint at <http://www.appliedbuildingtech.com/content/air-space-r-value>, and the research report referenced in the bibliography.



Bibliography: Evaluation of Reflective and Non-Reflective Airspaces for Energy Code and FTC R-value Rule Compliance, ABTG Research Report No. 1601-02, Applied Building Technology Group, LLC, <http://www.appliedbuildingtech.com/rrr/1601-02>

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The use of airspaces for compliance is not a requirement in the code and is therefore optional. This proposal provides for the option to appropriately include the R-value of airspaces which may reduce the cost of construction. For current applications that are using the R-value of airspaces that are not appropriately quantified or constructed, the cost of construction may increase. Thus, the appropriate conclusion is that the proposal may

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are question cost statement and enforceability of air flow and air rate. Additionally there is technical disagreement among experts (Vote: 11-0).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proponents:

Amanda Hickman, representing Reflective Insulation Manufacturers Association International (amanda@thehickmangroup.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces Where the R-value of an airspace is used for compliance in accordance with Section R401.2, the airspace shall be in an unventilated cavity constructed to minimize airflow into and out of the enclosed air space. Airflow shall be deemed minimized where the enclosed air space is located on the interior side of the continuous air barrier and bounded on all sides by building components.

~~**Exception:** Alternative airspace conditions and means of determining R-value shall be permitted in accordance with Section C402.2.7.~~

Commenter's Reason:

The originally proposed language is lacking in some of the important characteristics of an "enclosed air space" – the addition of "unventilated cavity" and "bounded on all sides by building components" incorporates important characteristics, which this system should include.

The primary problem with the intent of this language is that it mixes two distinctly different systems and attempts to incorporate them into a single subsection, specifically "unventilated" and "ventilated" enclosed air spaces (the "Exception" includes a reference to Section C402.2.7 which includes an exception that addresses "ventilated" systems).

Section C402.2.7 Airspaces is very efficient in identifying the attributes of an enclosed air space – "enclosed in an unventilated cavity...and is bounded on all sides by building components". These systems are routinely tested with ASTM test method C1363. The stipulation that the enclosed air space must be inside the air barrier is unnecessary – enclosed air spaces meeting the above criteria can exist inside or outside the air barrier. The key element to this discussion is "unventilated" – if the system is unventilated it can be tested, and a thermal performance value assigned.

This text refers to the "C402.2.7" which includes an "Exception" that addresses "ventilated systems" which is unsubstantiated code language and premature:

The Exception from Section C402.2.7 is included below, for this discussion:

Exception: the thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

Ø There is no ASTM test method available for the stated requirements

Ø What is the basis for the stated flow rate requirement?

Ø Should not a flow rate be assigned to specific assemblies?

Ø What supportive data and what test procedure are utilized in determining these flow rates?

There are significant gray areas included within the exception – the Public Comment remedy is to eliminate the “Exception” and remove the restrictive language that specifies where an enclosed air space is located.

Once the additional work has been completed and testing requirements for a ventilated system are identified, it will be appropriate to develop code language specific to the assemblies being discussed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Because the use of airspaces is optional and not required by code there is no cost impact associated with the proposal. And because this comment only modifies the proposed language it inherently does not have a cost impact.

Public Comment# 1654

Public Comment 2:

Proponents:

Doug Kinninger, Fi-Foil Company, representing Fi-Foil Company; Amanda Hickman, representing Reflective Insulation Manufacturers Association International (amanda@thehickmangroup.com)

requests Disapprove

Committer's Reason: The “Exception”, for reference, from Section C402.2.7:

Exception: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

The “Cost Impact” for this proposal is in error. It specifies a “new” test method for air spaces outside the air barrier. The ASTM C1363 test method is expensive and would certainly impact material costs for the system.

Additionally, it only specifies one “air movement rate”, but does not indicate the assembly or supporting test data that pertains to this air movement rate. Different ventilated assemblies outside the air barrier will have different flow rates and the exception should include a test method to determine the flow rate for that specific assembly. Additionally, the cost of a second test method to determine air movement flow rate would have associated costs that would increase the material costs, for the assembly even more.

Currently, ASTM C1363 does not permit the introduction of air flow for thermal evaluation of an assembly. This is an additional issue of importance that justifies disapproval.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1665

RE66-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be air sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be <u>air sealed in a manner that does not interfere with its accessibility.</u>	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. All access hatches and doors shall be installed in accordance with Section R402.2.4 <u>Raised vertical or diagonal surfaces that are greater than 1' foot in height into the ventilated attic shall be insulated in accordance with the knee wall provisions.</u> <u>Raised vertical or diagonal surfaces that are 1 foot or less in height into a ventilated attic shall be buried with insulation to maintain the ceilings R-value.</u> <u>Eave Baffles shall be installed in accordance with Section R402.2.3</u>
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framewalls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jamb of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the	Exterior walls adjacent to showers and tubs shall be insulated.

	shower or tub.	
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Air barrier and air sealing criteria section:

- Air sealing measures are called out so the table column should incorporate air sealing in its name as it is different than air barrier.
- We are seeing attic access hatches caulked shut so the included language change is to ensure that access to the attic space is maintained.

Insulation installation criteria section:

- Section references have been incorporated in the proposed language change as code required installation issues have been defined in those sections of the code. The problem from an implementation perspective is that the defined installation is in the prescriptive section of the code. So, does the code intend for attic eave baffles to be traded off or not installed if a home uses R405 or R406 compliance paths? I don't believe so. Therefore, the inclusion of section references ensures enforcement language and that the section becomes mandatory for all pathways in the code as it should be.
- Raised ceiling that penetrate into the attic space are particularly difficult to insulate. The guidance given by the proposed language helps those in the field identify particularly difficult areas to insulate, as well as, guidance on how to successfully meet the code requirement.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE66-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposed language is guidance, not code language (Vote 8-3).

Assembly Action:

None

RE66-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. shall be aligned with the insulation and any gaps in the air barrier shall be air sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air sealed in a manner that does not interfere with its <u>access accessibility</u> .	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. Raised Vertical or diagonal surfaces that are greater than 1' foot in height into the ventilated attic shall be considered an above grade wall, insulated in accordance with the knee wall provisions. Raised Vertical or diagonal surfaces that are 1 foot or less in height into a ventilated attic shall be buried with insulation to maintain the ceilings <u>required</u> R-value. All Access hatches and doors shall be installed in accordance with Section R402.2.4 Eave Baffles shall be installed in accordance with Section R402.2.3
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jamb of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the	Exterior walls adjacent to showers and tubs shall be insulated.

	shower or tub.	
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: The committee stated, "The proposed language is guidance, not code language." I believe that this comment is primarily focused on the insulation installation section as the air barrier section further clarifies requirements that are already part of the code table. However, redundancy in the existing language was discovered and corrected. Alignment of the insulation with the air barrier was discussed on both sides of the table and this has been fixed in the public comment. The committee comments were taken to heart, and additional significant changes were made to enhance the code language.

On the insulation installation side of the table, raised ceilings that penetrate into the attic space are a common construction detail that is particularly difficult to insulate and needs to be addressed by the code. Redundancy in the proposed language has been fixed which helps those in the field identify this difficult area to insulate, as well as provide language on how to successfully meet the new code requirement.

The committee questioned two code references added to the Insulation side of the table are Section R402.2.3 Eave Baffles and R402.2.4 Attic Hatches. There is a lot of precedence in code language to point to sections for additional clarification, especially for installation guidance that is already in the code. These specific reference sections describe the installation of these measures in the prescriptive section of the code. Installation criteria in the prescriptive section of the code cannot be traded in performance paths. The installation of attic eave baffles, for example, is not discretionary and cannot be traded off when building an attic ventilated with soffit vents. Pointing to reference language makes this clear.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language changes do not increase the cost of construction but rather removes redundancy and offers greater clarity of existing requirements.

Public Comment# 1714

RE67-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	<p>A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier.</p> <p><u>The building's thermal envelope shall contain a continuous air barrier that is in alignment with the insulation on the conditioned and unconditioned side of the assembly.^b</u></p> <p>All penetrations breaks or joints in the air barrier assembly shall be <u>air sealed</u>.</p>	<p>Air-permeable insulation shall not be used as an air a sealing material.</p> <p><u>Air- permeable insulation shall be enclosed inside the air barrier assembly ^b.</u></p> <p><u>Verification or certification of insulation installation shall be in accordance with Section R303</u></p>
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—

HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
- b. Air barrier and Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: Air barrier and air sealing criteria section:

- This code change proposal is intended to offer clarification to this section of Table R402.4.1.1 for those in the field that use it to build homes that are compliant with the air testing requirements of the IECC. In the 2018 IECC definitions section, air barriers and building thermal envelope were changed to recognize that the air barrier and building thermal envelope are an assembly of things not necessarily one component of the building. See definitions below. By removing poor language regarding continuous air barriers this section has been focused to better define the alignment of the air barrier and thermal barrier. In addition, it offers definition for other requirements in the table for installing an interior air barrier in location like behind a tub.
 - o **AIR BARRIER.** One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.
 - o **BUILDING THERMAL ENVELOPE.** The *basement walls, exterior walls, floors, ceiling, roofs* and any other *building element assemblies* that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.
- Air sealing measures are called out so the table column should incorporate air sealing in its name as it is different than air barrier.

Insulation Installation Criteria:

- Manufacturers of air permeable insulation have begun to recognize that their installation literature must incorporate language and pictures showing that air permeable insulation must be enclosed inside of air barrier assemblies. This table promotes this installation instruction in location such as behind tubs, on attic knee walls, etc. Therefore, the general section should begin with an overarching statement that states how air permeable insulation shall be installed.
- See insulation installation instructions from NAIMA (*North American Insulation Manufacturers Association*) at this weblink: <http://insulationinstitute.org/wp-content/uploads/2016/03/NAIMA-Tech-Tips-and-Critical-Details-FINAL.pdf>

A footnote has been added to ensure a common understanding that insulation installed in a ventilated attic and at the rim joist is not required to be enclosed within an air barrier assembly. The new footnote is necessary as the item it is associated with defines the installed alignment between air barriers and air permeable insulation within building cavity installation, i.e. walls and floor cavities.

Using references to other sections of the code enables reinforcement of what is required. In this case, the reference is to certificates that document the R-values of the material installed which must be created and posted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE67-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The proposal is very confusing, there is no need to reference existing section of code (Vote: 8-3).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier that is in alignment with the insulation shall be installed in the <i>building thermal envelope assembly</i> .	Air-permeable insulation shall not be used as an air a sealing material.
	The building's thermal envelope shall contain a continuous air barrier that is in alignment with the insulation on the conditioned and unconditioned side of the assembly.^b	Air- permeable insulation <u>installed in wall or floor cavities</u> , shall be enclosed <u>on all sides with air impermeable materials.</u> ^b inside the air barrier assembly .
	All Penetrations, breaks, or joints in the air barrier assembly shall be air sealed.	Verification or certification of insulation installation shall be in accordance with Section R303

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
- b. ~~Air barrier and insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.~~ Full enclosure of insulation with an air-impermeable material is not required in unconditioned/ventilated attic spaces and at rim joists.

Commenter's Reason: Public Comment Reason Statement:

This comment is being put forth to address committee concerns regarding confusion in the proposed language and the use of a reference section for insulation installation R303. The current published language in the air barrier section of table R402.4.1.1 of the 2018 IECC states, "A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope shall contain a continuous air barrier." This is completely confusing for those charged with implementation and enforcement in the field. In an effort to create even better code language, as suggested by the committee, this section has been significantly simplified and made to align with RE58 that passed, for better clarity and understanding. However, RE58 did not address the insulation installation side of the table which this proposal does.

Section R303 regarding insulation installation is often overlooked. However, it offers additional installation criteria that goes beyond manufacture instruction -- for example, additional information regarding blow or sprayed roof or ceiling insulation. The committee also approved CE 40 parts I & II, a new section numbered R303.3.1 Insulation Mark Installation, which will require obtaining a certificate of installation for an insulation material that does not have an R-value mark at the time of installation. These are examples of the importance of using references to other sections of the code. In addition, there are multiple precedents for citing sections of the code that need to be referenced. This includes other parts of this table that were approved at the CAH -- for example, RE70 recessed lighting and RE 71 garage separation.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction but rather offers better clarity of existing requirements.

RE68-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring, or other obstructions	<u>All holes created by wiring, plumbing or other obstructions in the air barrier assembly shall be air sealed.</u>	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring. <u>Insulation shall be installed to fill the available space and surround wiring, plumbing, or other obstructions, unless the required R-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions.</u>
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
	HVAC supply and return register boots that	

HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component:

- The component section of this table item has been amended to include other obstructions as there are a number of obstructions that end up in insulated building cavities that insulation must be split around so that it fully encloses the obstruction. In this revised section plumbing and wiring become examples of obstructions, but things like gas or HVAC duct works amongst other things now can be included.

Air barrier and air sealing criteria section:

- Although it seems obvious it does need to be stated that holes in the continuous air barrier need to be sealed. This is a specific reminder regarding holes that are created by wiring, plumbing, or other obstruction in cavities need to be air sealed.

Insulation Installation Criteria:

- Insulating around obstructions in building cavities can and may happen with material other than fiberglass batts. This code change proposal opens up the possibility of insulating plumbing in exterior walls, for example, so that the plumbing is not surrounded by insulation but rather completely exposed to the warm side of the cavity.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements.

RE68-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It is not necessary it brings guidance into the table (Vote: 6-5).

Assembly Action:

None

RE68-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Plumbing, wiring, or other obstructions	<p>All Holes created by wiring, plumbing, <u>wiring</u>, or other obstructions in the air barrier assembly shall be air sealed.</p>	<p>Insulation shall be installed to fill the available space and surround wiring, plumbing, wiring or other obstructions, unless the required R-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions.</p> <p><u>Where the required cavity insulation cannot be achieved due to an installed obstruction, the required R-value shall be installed to the exterior side of the obstruction and the remainder of the cavity shall be fully insulated to the drywall side, or an air barrier shall separate the two.</u></p>

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement:

The committee's vote of 6 to 5 indicates that there was not agreement on whether this proposal is only offering guidance of true code requirements in the best available code language. That being said, their comment has been taken to heart and changes have been made to address concerns in the following ways:

- Currently, there are no clear and direct air barrier requirements for this section of the table. Therefore, a clear air sealing requirement in the air barrier section has been added to clarify the importance of a continuous air barrier system.
- There was no understanding that the same principles of installation apply for other obstructions such as gas lines, ducts, low voltage, or other things we find inside building cavities that obstruct the direct installation of the air barrier and insulation. In other words, insulation must be split to fit around not only wiring but also any obstruction that is installed within an insulated cavity.
- Lastly, the public comment addresses the committee concern that cavity insulation R-value is maintained when large obstructions, such as ducts, are installed in an insulated cavity. To address this a section of the language was broken out into its own statement requiring that insulation and air barrier systems be held outside the obstruction. This exception offers alternative insulation installation allowances which are often used when plumbing, for example, must be installed in an exterior wall.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction, but rather offers clarity of existing requirements.

RE71-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	<u>Insulated portions of the garage separation assembly shall be installed in accordance with Section R303 and R402.2.8</u>
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is	

Concealed sprinklers	recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
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a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Insulation Installation Criteria:

- Many in the field that use table R402.4.1.1 use it as a guide to how to meet the requirements of the codes insulation and air leakage sections. Currently the component section for garage separation is blank on the insulation installation column. Unfortunately, many feel that because the section is blank that there is not a requirement to install insulation in the same manner as any other wall or floor component that separated conditioned and unconditioned space. Therefore, there is need to ensure that the installation criteria is used when assessing R402, R405 and R406 compliance. The addition of this language does that.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE71-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Adds clarity by providing more specificity (Vote: 6-5).

Assembly Action: **None**

RE71-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests Disapprove

Commenter's Reason: RE71 brings a reference to R303 into the table as part of the row on "garage separation". None of R303 is specific to "garage separation", why should R303 fall under that row? The sections in R303 are:

- R303 Materials, Systems and Equipment.
- R303.1 Identification.
- R303.1.1 Building thermal envelop insulation.
- R303.1.1.1 Blown-in and sprayed roof and ceiling insulation.
- R303.1.2 Insulation mark installation.
- R303.1.3 Fenestration product rating.
- R303.1.4 Insulation product rating.
- R303.1.4.1 Insulated siding.
- R303.2 Installation.
- R303.2.1 Protection of exposed foundation insulation.
- R303.3 Maintenance information.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1937

RE73-19

IECC: R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening shaft openings, and other similar penetrations to the exterior or unconditioned space shall be <u>air</u> sealed.	<u>Penetrations through the building thermal envelope and what is passed through the penetration, shall not damage or compress the insulation surrounding the penetration.</u>

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Air barrier and air sealing criteria section:

- There are a number of penetrations that occur through the continuous air barrier assemblies of a home. They are too numerous to list yet some examples are given to create context and additional language was added to ensure that the examples were not thought to be the only penetrations that needs to be sealed.

Insulation Installation Criteria:

- Insulating properly around a penetration and the object that is placed through the penetration in the buildings continuous air barrier assembly and thermal envelop is relatively easy to accomplish when insulation is installed after the penetration has been sealed, but when insulation has been installed first and then a penetration is created damaged insulation often occurs. In either instance this new language points out that insulation still must be installed well regardless.

See the following:

**Table R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION ^{1,2,4}**

COMPONENT	AIR BARRIER AND AIR SEALING CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaft openings, or other similar penetration to the exterior or unconditioned space shall be air sealed.	Penetrations through the building thermal envelope and what is passed through the penetration, shall not damage or compress the insulation surrounding the penetration.

Reason Statement:

Air barrier and air sealing criteria section:

- There are a number of penetrations that occur through the continuous air barrier assemblies of a home. They are too numerous to list yet some examples are given to create context and additional language was added to ensure that the examples were not thought to be the only penetrations that needs to be sealed.

Insulation Installation Criteria:

- Insulating properly around a penetration and the object that is placed through the penetration in the buildings continuous air barrier assembly and thermal envelop is relatively easy to accomplish when insulation is installed after the penetration has been sealed, but when insulation has been installed first and then a penetration is created damaged insulation often occurs. In either instance this new language points out that insulation still must be installed well regardless.



Cost Statement:

- The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE73-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The is to provide guidance and as such it does not belong in the code. It is poor code language and not enforceable (Vote: 7-4).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct and flue shafts, utility penetrations, , flue shaft openings , and other similar penetrations to the exterior or unconditioned space shall be air sealed <u>to allow for expansion, contraction, and mechanical vibration.</u>	<p><u>Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the <i>building thermal envelope</i> to maintain required R-value.</u></p> <p>Penetrations through the building thermal envelope and what is passed through the penetration, shall not damage or compress the insulation surrounding the penetration.</p>

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement

The committee's vote was 7-4, and I disagree with committee members who thought this code change proposal only provides guidance and voted to disapprove. That being said, the committee reason statement and the passage of RE86 demonstrates that additional work was needed. The air barrier side of the table has been updated to create better language and incorporate RE86 language.

The insulation installation side of the table clearly provides a new code requirement that ensures that what passed through shaft and other penetrations is insulated properly to maintain its required R-value.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

§ The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

RE74-19

IECC: R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls, basement walls, and slabs	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.11 with overlapping joints taped. <u>A class 1 vapor retarder shall not be installed on the interior side of air permeable insulation in exterior below-grade walls.</u> <u>All penetrations through concrete foundation walls and slabs shall be air sealed.</u>	Crawl space wall insulation installation, where provided instead of floor insulation, shall be permanently attached to the walls installed in accordance with Section R402.2.11. <u>Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.9.</u> <u>Slab on grade floor insulation shall be installed in accordance with Section R402.2.10.</u>
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed	—

walls	boxes shall be installed.	
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component:

- Currently only crawl space walls are being addressed by this table. Other foundation types such as basement and slabs have components that need to be addressed, thus the proposal to change the title of this component section.

Air barrier and air sealing criteria section:

- The vapor retarder criteria outlined in the prescriptive section R402.2.11 clearly describes how vapor retarders must be installed over the dirt floor of a conditioned crawl space. There is no need to further explain it in this table, but there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.
- Borrowing from language used in the EnergyStar checklist, I have used this section to ensure that below grade walls are insulated, but do not contain a class 1 vapor retarder that can trap moisture behind them. More vapor permeable materials such as class 2 Kraft faced batts or perforated vinyl or FSK (foil scrim kraft) blankets, as well as, class 3 vapor retarders are allowed. In Colorado we do see class 1 vapor retarders installed in this location and efficiency a building durability issue occur.
- Many feel that concrete foundation walls and slabs are air tight, but we forget that these building assemblies are often penetrated with sump pits, plumbing lines, and the like. These locations must be addressed in order to meet the air leakage requirements of the code.

Insulation Installation Criteria:

- Crawl space insulation installation as outlined in the prescriptive section R402.2.11 clearly describes how insulation must be installed on this component. There is no need to further explain it in this table, but there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.
- Basement wall insulation installation is outlined in the prescriptive section R402.2.9 and clearly describes how insulation must be installed on this component. However, basement walls were never included as a component of this table. Therefore, there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.
- Likewise slab insulation is outlined in the prescriptive section R402.2.10 and clearly describes how insulation must be installed on this component. However, slab insulation was never included as a component of this table. Therefore, there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE74-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Walls and floors should be separated as should slab-on-grade and basements. They should not be together (Vote: 8-3).

Assembly Action:

None

RE74-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
<u>Basement, crawl space walls, basement walls, and slab foundations</u>	<p>Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.11.</p> <p>All Penetrations through concrete foundation walls and slabs shall be air sealed.</p> <p><u>Class 1 Vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with the International Residential Code Section R702..7.</u></p> <p>A class 1 vapor retarder shall not be installed on the interior side of air permeable insulation in exterior below-grade walls.</p>	<p>Crawl space wall insulation installation, where provided instead of floor insulation, shall be installed in accordance with Section R402.2.11.</p> <p>Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.9.</p> <p>Slab on grade floor insulation shall be installed in accordance with Section R402.2.10.</p>

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement

The committee's concern with this proposal was that it mixed wall and floor details. In reality, it is all about foundation air sealing and insulation installation. Therefore, to remove the committee's concern, the section has been renamed "Basement, crawl space, and slab foundations." Now all foundation air sealing, air barrier, and insulation installation issues that need to be addressed are in one place. They include references to the prescriptive installation requirements that cannot be traded as they are not associated with R-values that can be traded in the performance paths.

There is a lot of precedence in code language to point to sections for additional clarification, especially for installation guidance. The specific reference sections used in this proposal describe the installation of measures in the prescriptive section of the code. Installation criteria in the prescriptive section of the code cannot be traded in performance paths. Although the R-value of crawlspace wall insulation can be traded off, the installation of crawlspace wall insulation is not discretionary and cannot be traded off when building a conditioned crawlspace. Pointing to reference language makes it all clear.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

Public Comment# 1740

RE75-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jamb of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, <u>separating conditioned from unconditioned space</u> , including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation. <u>Floor cavity air permeable insulation shall be enclosed inside an air barrier assembly</u> - <u>Floor systems shall be fully air sealed including continuously air sealed at all edge and perimeter rim joist framing members.</u>	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members in accordance with the requirements of Section R402.2.8.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be	—

	installed.	
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component:

- It needs to be clear that the floor cavities that are being addressed by this table are only floors that separate conditioned from unconditioned space. It is surprising how not all understand this.

Air barrier and air sealing criteria section:

- Floor cavities are wall cavities laid down, therefore, air permeable insulation installed inside the cavity also needs to be enclosed by the air barrier assembly. As the IECC allows alternative insulation techniques for insulating floors as seen in the exceptions detailed in Section R402.2.8 it become more important to ensure that the rim joist of the insulated floor not only get insulated, but is air tight, because the insulation no longer must be installed adjacent to the subfloor decking. The proposed language change brings this to light for builders and trades that are executing the code requirements.

Insulation Installation Criteria:

- The insulation installation criteria outlined in the prescriptive section R402.2.8 clearly describes how insulation in floor systems must be installed. There is no need to further explain it in this table, but there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE75-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is to provide guidance and as such it does not belong in the code. It is poor code language and not enforceable (Vote: 6-5).

Assembly Action:

None

RE75-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Floors, separating conditioned from unconditioned space, including cantilevered floors and floors above garages	<p>The air barrier shall be installed and air sealed at any exposed edge of the insulated cavity adjacent to unconditioned space.</p> <p>Floor cavity air permeable insulation shall be enclosed inside an air barrier assembly</p> <p>Floor systems shall be fully air sealed including continuously air sealed at all edge and perimeter rim joist framing members.</p>	Floor framing cavity insulation shall be installed in accordance with the requirements of Section R402.2.8.

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement:

The committee's vote of 6 to 5 tells us there was not agreement on whether this proposal offered only guidance or true code requirements in the best available code language. Their comment has been taken to heart, however, and changes have been made to make this proposal better. The proposal has been simplified since RE53 passed at the CAH (R402.2.8 Floor Insulation Installation) and continues to ensure that the floor insulation installation requirements of the prescriptive section R402.2.8 will be followed regardless of the pathway that is chosen.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

Public Comment# 1743

RE79-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be air sealed to the subfloor, wall covering or ceiling penetrated by the boot.	<u>HVAC supply and return register boots located within the buildings thermal envelope shall not damage or compress the insulation surrounding them.</u>
	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is	

Concealed sprinklers	recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
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a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Air barrier and air sealing criteria section:

- The change to this section of language in the table slightly broadens the scope of sealing to not only include air sealing between inside and outside but to include sealing of all supply and return boots to the surface they penetrate. This helps to gain more control and predictability of air flow in and out of interstitial spaces as well as improves the performance of the HVAC system. This concept was first introduced by the EnergyStar program.

Insulation Installation Criteria:

- Nationally we like open floor plans which means that more and more duct is being installed in exterior walls and attics. The supply and return duct installation and the insulation installation must be coordinated so that the insulation is not damaged or compressed resulting in the reduction of required R-value.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements.

RE79-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is a significant change, requiring all boots be sealed, and there is no evidence it is needed (Vote: 9-2).

Assembly Action:

None

RE79-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
HVAC register boots	HVAC supply and return register boots shall be air sealed to the subfloor, wall covering or ceiling penetrated by the boot.	<p>Insulation shall be fitted tightly around HVAC supply and return register boots located in the <i>buildings thermal envelope</i> to maintain required <i>R-value</i>.</p> <p>HVAC supply and return register boots located within the <i>buildings thermal envelope</i> shall not damage or compress the insulation surrounding them.</p>

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment:

As noted in the original reason statement and the committee comment, this proposal is a significant change to this section. It requires that all supply and return registers be sealed to the surface they are penetrating. The origin of this air sealing requirement comes from ENERGY STAR, who has demonstrated that energy loss is associated with duct boot installation in three ways: 1) if the boot directly penetrates the thermal envelope, such as a duct boot coming from a ventilated attic into the house; 2) when air that should be delivered to the conditioned space is redirected into building cavities when it hits the register cover; 3) when Venturi pressure, sometimes called the Coanda effect, is created and pulls air into the building cavity as it is being delivered into the room.

Read more here, <https://www.achrnews.com/articles/128615-why-dirt-streaking-occurs-around-vents>

By not being able to deliver the HVAC designed volume of air to the rooms of the house, the occupant is often left with no other choice than to raise the thermostat in the winter and to lower it in the summer. This causes energy inefficiencies while not correcting their comfort issue. In addition, building cavities are often connected to unconditioned space which increases duct leakage to the outside, as well as other inefficiencies. Therefore, although I agree with the committee that this is a significant change, I also believe that it is an important energy and building durability issue. This needs to be addressed at this time because most builders and contractors have experience implementing this in part, if not in whole.

There have not been insulation requirements associated with duct boots in the past which continues to make this a significant code change proposal. Ensuring that our building cavities are insulated properly is imperative when ducts are placed in them, and this proposal directly addresses that issue at the termination of the duct boot and the substrate it passes through.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As the committee noted this proposal changes the scope of the requirement (additional boots need sealed) and therefore would slightly increase the cost of construction. However, the proposal, in reality, offers better clarity and expansion of existing requirements.

Public Comment# 1745

RE80-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jamb of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical, phone, fan or other utility boxes on exterior walls/ceilings	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed. Electrical, phone, fan or other utility boxes shall be air sealed or air tight boxes shall be installed. Electrical, phone, fan or other utility boxes, that penetrate the building thermal envelope, shall be air	<u>Spaces behind electrical, phone, fan or other utility boxes on exterior walls shall be insulated or filled by insulation that on installation readily conforms to the available cavity space.</u> <u>Electrical, phone, fan or other utility boxes installed in floors, attics or to other insulated spaces shall have insulation cut or blown to fit snugly around them or upon installation readily conforms to the available space.</u>

	<u>sealed to the subfloor, wall covering or ceiling penetrated by the box.</u>	
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component column:

- Although technically speaking, low voltage, speaker, or computer wire boxes are a form of electrical box many builders and trade partners only view true 20- or 15-amp power outlet or switch gang boxes as electrical boxes. By simply broadening the definition to utility box we can ensure that any such box that is installed in an exterior wall or ceiling is insulated and air sealed properly.

Air barrier and air sealing criteria section:

- In this section the two requirements have been broken apart for greater clarity. First an air tight box of some sort must be installed and second the box must be sealed to the surface that it penetrates.

Insulation Installation Criteria:

- Currently there is no guidance in this table regarding insulating behind electrical boxes in any insulated assembly. This added language rectifies this and offers guidance.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements

RE80-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are already penetration sealing requirements, snugly is a poor word choice (Vote: 6-5).

Assembly Action:

None

RE80-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
<p>Electrical, phone, fan or other utility boxes on exterior walls/ceilings</p> <p>Utility boxes (fan, electrical, communication, etc.)</p>	<p><u>The air barrier shall be installed behind utility boxes within the building thermal envelope.</u></p> <p><u>Utility boxes shall be sealed or air-sealed boxes shall be installed.</u></p> <p><u>Utility boxes, that penetrate the building thermal envelope, shall be air sealed to the subfloor, wall covering or ceiling penetrated by the box.</u></p> <p>Electrical, phone, fan or other utility boxes shall be air sealed or air tight boxes shall be installed.</p> <p>Electrical, phone, fan or other utility boxes, that penetrate the building thermal envelope, shall be air sealed to the subfloor, wall covering or ceiling penetrated by the box.</p>	<p><u>Insulation shall be fitted tightly around and behind utility boxes installed in the buildings thermal envelope.</u></p> <p>Spaces behind electrical, phone, fan or other utility boxes on exterior walls shall be insulated or filled by insulation that on installation readily conforms to the available cavity space.</p> <p>Electrical, phone, fan or other utility boxes installed in floors, attics or to other insulated spaces shall have insulation cut or blown to fit snugly around them or upon installation readily conforms to the available space.</p>

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Committer's Reason: Public Comment Reason Statement:

The committee vote of 6 to 5 tells us that there was not unanimous agreement to disapprove this proposal. The committee stated that there are already penetration air sealing requirements is true. But both NEMA and I feel that more specific language for utility boxes is needed for those that implement and enforce these requirements in the field. In the field, it is necessary to point specifically to language that says that the fan housing or utility box needs to be sealed to the surface that it is penetrating. Specific language is better for enforcement than general language, but the reality is that both general and specific language is needed. To address committee concerns, in collaboration with NEMA new air barrier language has been drafted.

The committee also had an issue with the word "snugly" to describe how insulation should be installed around a utility box. That word has been removed, and the language was changed. With the help of NEMA, the reworked language of this proposal should satisfy the concerns of the committee.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction because sealing box penetrations through the thermal envelope is required. However, this proposal does offer clarity of existing requirements.

RE81-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub and fireplaces on exterior wall walls	<p>The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.</p> <p><u>An air barrier shall be installed to separate the exterior wall insulation from showers, tubs and fireplaces.</u></p> <p><u>Tub and shower drain trap penetrations through the subfloor shall be air sealed.</u></p> <p><u>Fireplace doors shall comply with the requirements of Section R402.4.2</u></p>	<p>Exterior walls adjacent to showers, and tubs, and fireplaces shall separate the wall from the shower or tub be insulated and, where insulated with air permeable insulation, shall be enclosed by an air barrier assembly.</p>

Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component column:

- The 2012 IECC Air barrier and Insulation table was the last table that specifically referenced the void space behind fireplaces that are located on exterior walls. Just like behind tubs and shower pans a supplemental air barrier is needed on the interior side to enclose the insulation as the drywall plain has been moved to the front of the fireplace.

Air barrier and air sealing criteria section:

- This first revision continues to require the installation of a supplemental air barrier in areas where drywall, tile backer, or other air impermeable material will not be installed as the finished surface is not in alignment with the insulation installed in the building's thermal envelope. The only addition, other than clarification, is the addition of the area behind fireplaces on exterior walls.
- Air sealing the tub and shower drain trap penetration eliminates a significant leakage source especially when located in floor systems over unconditioned spaces. This air leakage often creates condensation on the back side of tubs and shower pans which leads to mold and other building durability issues.
- Fireplace door air sealing is outlined in the prescriptive section R402.4.2 and clearly describes that this component shall be air sealed. The instruction should not be limited to fireplaces that are installed using the prescriptive compliance options. Therefore, there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.

Insulation Installation Criteria:

- Manufactures of air permeable insulation have begun to recognize that their installation literature must incorporate language and pictures showing that air permeable insulation must be enclosed inside of air barrier assemblies. The current language offered no guidance of this fact and therefore was amended.
- See attached PDF example of newer installation instructions

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements.

RE81-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The cost benefit statement does not reflect the proposed change in requirements (Vote: 10-1).

Assembly Action:

None

RE81-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shower/tub and fireplaces on exterior <u>framed</u> walls	<p>An air barrier shall be installed to separate the exterior <u>framed</u> wall insulation from showers, tubs and fireplaces.</p> <p>Tub and shower drain trap penetrations through the subfloor shall be air sealed.</p> <p>Fireplace doors shall comply with the requirements of Section R402.4.2</p>	<p>Exterior <u>framed</u> walls adjacent to showers, tubs, and fireplaces shall be insulated.</p> <p>and, where insulated with air permeable insulation, shall be enclosed by an air barrier assembly.</p>

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: The committee's comment demonstrated concern that the cost statement did not accurately reflect the increased cost associated with sealing tub and shower drain trap penetrations. This has been remedied below. In addition to the committee's concern, a representative of the masonry institute raised issues with reintroducing specific fireplace language requirements and the potential impact on masonry fireplaces. To address these concerns and in collaboration with industry representatives, the language, "framed" has been introduced for clarity.

Bibliography: For additional reason why it is important to seal holes created by plumbing traps go here.

JLC Practical Air-Sealing

https://www.ilconline.com/how-to/insulation/practical-air-sealing_o

This Hole May Be the Biggest Air Leakage Site in Your Home

<https://www.energyvanguard.com/blog/52889/This-Hole-May-Be-the-Biggest-Air-Leakage-Site-in-Your-Home>

The 3 Rules of Air Sealing

<https://www.energyvanguard.com/blog/56102/The-3-Rules-of-Air-Sealing>

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The committee's comment demonstrated concern that the cost statement did not accurately reflect the increased cost associated with sealing tub and shower drain trap penetrations. Although the proposed language is designed primarily to clarify the requirements of the code in this section, specifically regarding the area created by framed fireplace boxes, it will increase the cost of construction. The proposal also addresses the need to air seal tub and shower drain trap penetrations which have been demonstrated to largely contribute to air infiltration and building durability through condensation control.

RE84-19

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	<p>The junction of the foundation and sill plate shall be <u>air sealed</u>.</p> <p>The junction of the <u>all top plates and drywall adjacent to unconditioned space above</u> shall be <u>gasketed or air sealed</u>.</p> <p>Knee walls shall be <u>air sealed</u>.</p>	<p><u>Wall and knee wall cavity air permeable insulation shall be enclosed inside the air barrier assembly</u></p> <p><u>Corners in exterior frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.</u></p> <p><u>Headers on exterior walls shall be insulated to a minimum R-3.</u></p> <p><u>Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier assembly.</u></p> <p><u>Knee wall cavities that are defined by roof truss framing shall maintain a minimum 3.5" inch insulated cavity that can accommodate an R-value that is either required in the wall or can be traded off.</u></p>
Windows, skylights and doors	The space between framing and skylights, and the jamb of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.

Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Table title change

- The objective of table R402.4.1.1 is to offer guidance for how to create an air tight home that meets the air leakage requirements of the IECC. Air barrier and insulation installation are part of the equation to be able to accomplish this goal, but air sealing is another part of it that is missing from the title. The tables name should accurately reflect what it is intended to do and that is what the proposal aim is. Currently air sealing measures are discussed to some extent in the table and the hope is that additional air sealing measure will be incorporated this cycle.

Air barrier and air sealing criteria section:

- Clarification of the language requiring drywall to be sealed to the top plate is needed. In the field there is confusion regarding what exterior means. Does it mean four exterior walls or does it mean top plates that are adjacent to unconditioned space. The gained clarity of this air sealing activity addresses one of the largest air leakage sources on the high side of the home.
- The junction of the bottom plate to the subfloor on exterior walls had not been addressed yet is again one of the largest sources of air leakage in homes and therefore was added to the table.

Insulation Installation Criteria:

- Air permeable insulation must be enclosed in an air barrier in order to trap the pockets of air that are required to resist the flow of energy. This new language expresses that so it can be executed properly in the field.
- Corners and headers are significantly different assemblies. Headers, in particulate may not have a true cavity to insulate and may be better suited to insulate with foam board. This proposal breaks the two assemblies into separately addressed assemblies.
- Adding the defined term Building Thermal Envelop ensures clarity in this section of the code.
- Nationally we are seeing more and more knee walls that are defined by the flat edge of a 2x4 truss. The 1.5" dimension does not offer enough space to properly insulate. In such cases the truss will need to be over framed to enable insulation to be installed. The included language defines the minimum insulated space.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE84-19

Public Hearing Results

Errata: This proposal includes unpublished errata

Note: the bolded, stricken portion of existing code text did not show in the original proposal.

AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^a

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
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COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Walls	<p>The junction of the foundation and sill plate shall be <u>air sealed</u>.</p> <p>The junction of the <u>all</u> top plates and drywall adjacent to <u>unconditioned space</u> above shall be <u>gasketed or air sealed</u>.</p> <p>Knee walls shall be <u>air sealed</u>.</p>	<p>Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p> <p><u>Wall and knee wall cavity air permeable insulation shall be enclosed inside the air barrier assembly</u></p> <p><u>Corners in exterior frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.</u></p> <p><u>Headers on exterior walls shall be insulated to a minimum R-3.</u></p> <p><u>Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier assembly.</u></p> <p><u>Knee wall cavities that are defined by roof truss framing shall maintain a minimum 3.5" inch insulated cavity that can accommodate an R-value that is either required in the wall or can be traded off.</u></p>

1. a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Committee Action:

Disapproved

Committee Reason: It added words without clarity and could make the code more confusing (Vote: 10-1).

Assembly Action:

None

RE84-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AND INSULATION INSTALLATION^a**

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Walls	<p>The junction of the foundation and sill plate shall be air sealed.</p> <p>The junction of all top plates and drywall adjacent to unconditioned space above shall be gasketed or air sealed.</p> <p><u>The junction of the bottom plate to the subfloor on exterior walls shall be air sealed</u></p> <p>Knee walls shall be air sealed.</p>	<p>Wall and knee wall cavity Air permeable insulation <u>in wall cavities</u> shall be enclosed on all six sides of the cavity. inside the air barrier assembly</p> <p>Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier assembly.</p> <p>Corners in exterior frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, <u>with material that has an R-value</u> of not less than R-3 per inch.</p> <p>Headers on exterior walls shall be insulated to a minimum R-3.</p> <p>Knee wall cavities that are defined by roof truss framing shall <u>be insulated in accordance with the above grade wall provisions.</u> maintain a minimum 3.5" inch insulated cavity that can accommodate an R-value that is either required in the wall or can be traded off.</p>

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement

NAIMA recently released a paper titled "Five Priority Air Sealing Locations" from an Owens Corning study and listed the junction of the top plate and drywall adjacent to unconditioned spaces above as number one. They estimate that over 300 lineal feet of leakage is present. Multiply 300 feet by an 1/8" gap, and you get an almost 6060 window-size hole to the outside at this location. Our field experience shows that the current language in this section of the code causes confusion because it says, "seal the junction of the top plate and exterior wall." Many incorrectly assume that this means the top plate of the 4 exterior walls and not all top plates connected to the exterior or unconditioned space. So when the committee states that this code change is merely adding words, I need to push back and state that this code change clearly breaks up the many requirements in this section into bite-size bits of understandable code language. For example, insulated corners and headers were jumbled together in one long sentence. Now, they are separated and clarified so the requirement is clear and understandable.

Other Key air sealing areas that are being addressed by this proposal are

1. The junction of the foundation and sill plate shall be air sealed. (which is original language in this section)
2. The junction of the bottom plate to the subfloor on exterior walls shall be air sealed

Other committee comments have been addressed to streamline and search for better, more concise, and meaningful language to ensure clarity and reduce any confusion.

Bibliography:

<https://insulationinstitute.org/wp-content/uploads/2018/05/N090-5-Air-Sealing-Locations-for-New-Homes.pdf>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

RE85-19

IECC@: TABLE R402.4.1.1

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R402.4.1.1
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION^{a,b}**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for frame walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is	

Concealed sprinklers	recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
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- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
- b. The requirements of this table are mandatory in accordance with Section R402.4 and shall be applied to all components of the building's thermal envelope. Building elements not specifically addressed in the table shall be sealed, as appropriate, and consistent with the requirements of this table in order to maintain the continuity of the air barrier.

Reason: The objective of table R402.4.1.1 is to offer guidance for how to create an air tight home that meets the air leakage requirements of the IECC. Air barrier and insulation installation are part of the equation to be able to accomplish this goal, but air sealing is another part of it that is missing from the title. The tables name should accurately reflect what it is intended to do and that is what the proposal aim is. An additional footnote is being proposed here to first reiterate that the items included in this table are mandatory and second to show that in reality the principals demonstrated in the table are the important mandatory items. The code, and this table in particular cannot address every situation that will arise in the field. Therefore, the principals of installation air barrier, air sealing, and insulation installation demonstrated in the table must be clearly expressed and exemplified in order for builders and trade partners to successfully executed them regardless as unique instances of construction and installation occur.

For example, the table reinforces the need for the continuity of the air barrier assembly and its alignment with the thermal barrier of the home. The components described in the table express many of the situations where this must be executed but it can't explain every unique knee wall, tub, or fire fireplace surround. Therefore, the principals embodies in the table are used to successfully execute the continuity of the air barrier and alignment with insulation throughout the building thermal envelope.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE85-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It changes nothing in the code and the language does not make it more clear (Vote: 10-1).

Assembly Action: **None**

RE85-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Submitted

Commenter's Reason: While this Code Change Proposal may not make the language of the Code more clear, it does make the Code for enforceable. A prescriptive list of air-sealing measures will never be comprehensive as changes in construction techniques and technology will change the types of penetrations through an envelope. For example, while the existing table calls out shower and tub walls for air-sealing it does not mention fireplace walls. Similarly tv-cable boxes are not mentioned even though electrical and phone are. Common sense says all of these need to be sealed at the exterior walls. A strict reading of the Codes does not however. This additional language gives the code inspector the necessary leeway and backing and the construction team the necessary understanding to achieve the Code objectives in a common sense way.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction because it offers only guidance and clarity of existing requirements.

RE88-19

IECC: R202 (IRC N1101.6), R402.4.1.2 (IRC N1102.4.1.2) , R403.6 (IRC N1103.6)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com); Joseph Lstiburek, representing self (joe@buildingsscience.com); Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above.

R402.4 (IRC N1102.4) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

Revise as follows:

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or *dwelling unit* shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exception: An air leakage rate not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area shall be an accepted alternative in all climate zones for:

- 1.Attached single and multifamily building dwelling units.
- 2.Buildings or dwelling units that are 1500 square feet or smaller.

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building and each dwelling unit* shall be provided with ~~ventilation that complies~~ mechanical ventilation. The mechanical ventilation system shall comply with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Reason: Air changes per hour (ACH) is a volumetric calculation that is used to express air exchanges in a home when the house is brought to 50 Pascal's pressure with relation to outside. It is calculated using the house volume and the cubic feet per minute airflow rate as measured at the blower door to reflect the number of times each hour the volume of air in the house is exchanged with the outside. Although it can be used to express the air leakage rate of an efficient or inefficient home, it does not have a direct correlation with the holes through which air is passing and, therefore, is not a measurement that is best used to quantify how air tight a dwelling is. This is especially true for small volume and attached dwellings.

This proposal introduces an exception to using ACH to quantify air leakage in attached and small volume dwelling units because ACH is biased against small volume and attached dwellings. Although it is not difficult to get a single-family median size home to pass 3 or 5 ACH as required by the IECC, it is significantly difficult to get a small volume and or an attached home to pass. The alternative metric more accurately reflects leakage through the exterior enclosure area which removes built in volumetric bias while continuing to ensure a tight structure.

The alternative metric uses a cubic foot per minute (CFM) per square foot (ft²) of dwelling unit enclosure area metric to demonstrate compliance with

the IECC. This metric allows the air leakage measured at 50 Pascals divided by the building surface area to be used to assess the air tightness of the building enclosure. Unlike ACH, a CFM/ ft² of dwelling unit enclosure area normalizes the building air leakage per unit of building envelope surface area, the actual location where air is infiltrating or exfiltrating the dwelling regardless of where the air is coming from, which removes the volumetric bias that is causing small volume and attached dwellings units to fail the code require blower door test. In addition, it is not possible to only measure air leakage to the ambient outdoors in attached dwellings which is what ACH assumes. The air leakage measurement is actually quantifying the leakage that is coming from attached dwellings, stairs, elevator shafts or other parts of the building that may be connected to the living space of the tested unit. Air leakage from a conditioned space to any other space, as well as, two the ambient outdoors continues to be an energy efficiency issue, but it also is a health issue from an indoor air quality perspective, as well as, a building durability issue from a building science perspective. Reducing air leakage from all surfaces of the building enclosure promotes the IECC's intent while providing a metric that makes better sense for the building type in question.

The use of a more accurate reflection of air leakage that better represents the distribution of holes that are occurring in the building enclosure has begun to be adopted in programs such as EnergyStar, LEED, and Passive House and by standards created by the US Army Corp of Engineers and ASHRAE. Largely this is happening in multifamily construction as looking at the CFM/ft² of building enclosure area better represents leakage that is occurring in an attached dwelling unit. However, small volume is also a significant issue which this proposal addresses. The CFM/ft² of enclosure area will allow both small volume and attached dwellings to be more successful at meeting the intent and requirements of the code.

The proposal also defines "Dwelling Unit Enclosure Area" as the sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. In addition, the definition offers a small piece of defined guidance in order to further understand the measurement that must take place to calculate the dwelling unit enclosure area. This guidance states that the wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above. Lastly, the proposal ensures that the intent of the code, to ensure that the structure is built tight and ventilated correctly with mechanical ventilation, is maintained. If this exception is adopted into the code, as proposed, then ventilation must also be ensured regardless of how air tightness of the structure is expressed.

Why the change to R403.6?

It was pointed out in the last code cycle, that this metric could have an unintended loophole since it is not used in the IRC. To avoid that, the section was edited to ensure whole house mechanical ventilation continues to be required and installed

Why The change to IRC 303.4?

It was pointed out in the last code cycle, that this metric could have an unintended loophole since it is not used in the IRC. To avoid that, the section was edited to ensure whole house mechanical ventilation continues to be required and installed

Cost Impact: The code change proposal will decrease the cost of construction

This proposal would reduce cost for the following reasons.

- Some jurisdictions nationally allow Guarded testing, an alternative blower door testing method that attempts to only quantify air leakage between conditioned space and the outdoors. This testing method requires multiple individuals and blower doors to be run simultaneously. Using a CFM/ft² of enclosure area Metric ensures a tight building thermal enclosure in the most cost-effective way by only requiring one tester and piece of equipment per test.
- Air leakage pathways depend on the type of area separation assembly that is used between attached units. Some assemblies such as shaft liner areas separation walls are fairly tight from unit to unit and leak substantially to the outdoors while others promote leakage between units, common spaces, and other defined unconditioned spaces in the building. An enclosure test for attached dwellings allows for identification of the most cost-effective air sealing option per assembly that is chosen.
- Air sealing of exterior walls in mid to large size single family homes has become cost effective, repeatable, and achievable. Small volume homes don't have the same opportunities for sealing as volume is the primary driver not the number or size of holes to the exterior. Therefore, multiple re-inspections are needed and additional application of air sealing measures to chase down very small reductions in air leakage that still don't result in passing 3 and in some cases 5 ACH occur. A more reasonable metric for small volume dwelling would result in more passing units and less re-inspections while still meeting the tightness goals of the code.
- In attached housing there is an additional fire and air separation wall, floor, and or ceiling where often only a limited amount of air sealing is allowed. However, with a reasonable metric such a 0.30 CFM/ft² of enclosure area one is looking at the entire surface area. This creates parity with single family homes as they have the opportunity to address all surfaces of the dwelling when seeking to reduce the infiltration rate to pass the requirements of code.
- The value of allowing an exception to use 0.30 CFM/ft² of enclosure area is that air-sealing varies directly with the amount of surface area. Two dwellings can have surface area that differs by 15%, but still have the same volume and the current metric offers the same leakage allowance. If the surface area can be addressed in the measurement than the playing field is leveled and attached and small volume dwelling units would not have the problems passing the IECC.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exception: When testing individual dwelling units, an air leakage rate not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area, tested in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals), shall be ~~an accepted alternative~~ permitted in all *climate zones* for:

1. Attached single and multifamily building dwelling units.
2. Buildings or dwelling units that are 1500 square feet or smaller.

Mechanical ventilation shall be provided in accordance with Section M1505 of the International Residential Code or Section 403.3.2 of the International Mechanical Code, as applicable, or with other approved means of ventilation.

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building and each dwelling unit* shall be provided with ~~mechanical~~ ventilation. ~~The mechanical ventilation system shall~~ that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Committee Reason: The proposal will help solve a lot problems for testing smaller units, the modification adds a needed standard (Vote: 10-1).

Assembly Action:

None

RE88-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4.1.2 (IRC N1102.4.1.2)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exception: When testing individual dwelling units, an air leakage rate not exceeding 0.30 28 cfm per ~~ft²~~ square foot of the dwelling unit enclosure area shall be an accepted alternative in Climate Zones 1 and 2 and 0.17 cfm per square foot shall be an acceptable alternative in Climate Zones 3 through 8, tested in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals), ~~shall be permitted in all climate zones~~ for:

1. Attached single and multifamily building dwelling units.
2. Buildings or dwelling units that are 1500 square feet or smaller.

Mechanical ventilation shall be provided in accordance with Section M1505 of the International Residential Code or Section 403.3.2 of the International Mechanical Code, as applicable, or with other approved means of ventilation.

Commenter's Reason: This proposal should be approved as modified or, if not modified, disapproved. The Committee recommended approval of both RE88 and RE92. The two proposals are inconsistent as to values and application. This modification is intended to reconcile the differences between the two proposals by utilizing the more stringent cfm per square foot requirements of RE92 with the limited applicability of RE88 (applies to smaller homes and attached dwelling units). If RE88 is not modified, then the current code, or at least RE92, with the more stringent values, would be preferable. Our assessment is that the value proposed in RE88 (0.30 cfm) is a significant rollback in climate zones 3-8, where the current requirement for all homes is 3 ACH50. 0.17 cfm per square foot is a more comparable/acceptable value for these climate zones. To the extent that builders need additional flexibility to achieve air tightness requirements for multifamily dwelling units, we note that RE96, which was approved by the Committee and supported by a broad group of stakeholders, will already allow air leakage trade-offs up to 5 ACH50, as long as the efficiency losses are accounted for elsewhere in the unit.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. While the modification in this public comment adopts the more stringent air leakage requirement included in RE92, it still provides new options for testing air tightness in attached dwelling units and small single-family homes. We agree with the proponent that this additional flexibility could result in reduced costs in some cases. Since this is a new option, we assume that builders would only select it when it reduces costs as compared to current code requirements.

Public Comment# 1499

Public Comment 2:

IECC®: (New)

Proponents:

Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David A Eisenberg, DCAT, representing DCAT (strawnet@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

DWELLING UNIT ENCLOSURE AREA. The sum of the areas of ceiling~~s~~, floors, and walls ~~that separating separate the conditioned space of a dwelling unit's conditioned space from the exterior, or from its adjacent conditioned or unconditioned spaces, and adjacent dwelling units and common spaces.~~ Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above.

Commenter's Reason: This public comment does the following:

- Changes the definition of the term "dwelling unit enclosure area" to be consistent with the source definition in ASHRAE 62.2-2016 and that definition's intent.
- Removes ambiguous language from the proposal's definition while retaining its intent, as understood through communication with the proposal's team members.
- The word "or" is replaced with the word "and", with input from ICC staff. "And" is clearly the intent, where all of the included adjacency situations are meant to be included in calculating the dwelling unit enclosure area, not only any one of them. "And" is also the word used in the source definition.
- Strikes the last sentence in the proposal's definition because that sentence is not in the source definition and because the vertical dimension used to determine wall area is self evident.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment changes a definition only, and does not affect cost.

Public Comment# 1963

RE92-19

IECC@: SECTION R202 (IRC N1101.6), (New), R402.4 (IRC N1101.6), R402.4.1.2 (IRC N1102.4.1.2), SECTION R403 (IRC N1103), R403.6 (IRC N1103.6)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new text as follows:

DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above.

Revise as follows:

R402.4 (IRC N1101.6) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour or 0.28 cubic feet per minute (CFM) per square foot (ft²) of dwelling unit enclosure area in *Climate Zones* 1 and 2, and three air changes per hour or 0.17 CFM per (ft²) of dwelling unit enclosure area in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

SECTION R403 (IRC N1103) SYSTEMS

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). ~~The *building*~~ Each dwelling unit shall be provided with mechanical ventilation that complies . The mechanical ventilation system shall comply with the requirements of the International Residential Code or International Mechanical Code , as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Reason: Air changes per hour (ACH) is a volumetric metric that is useful for air quality measurements in buildings but is not the correct expression of air leakage from an energy or building durability perspective. This proposal introduces the ability to use an alternative cubic foot per minute (CFM) per square foot (ft²) of dwelling unit enclosure area metric for measuring air leakage in a building. In this way, the air leakage measured at 50 Pascals divided by the building surface area is used to assess the airtightness of the construction and building envelope. Unlike ACH, a CFM/ ft² of dwelling unit enclosure area metric normalizes the building air leakage per unit of building envelope surface area; the actual location where air is infiltrating or exfiltrating the building. To this end, the proposal also defines "Dwelling Unit Enclosure Area" as the sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. In addition, the definition offers guidance to further understand the measurement that must take place to calculate the dwelling unit enclosure area. This guidance states that the wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above. Lastly, the proposal ensures that the intent of the code, to ensure that the structure is built tight and ventilated correctly with mechanical ventilation, is maintained. If an additional option is adopted into the code, as proposed, then ventilation must also be ensured regardless of how air tightness of the structure is expressed.

Since 1980, The Energy Conservatory, has not only been a leader in air leakage science, but also one of the prominent manufacturers of the blower door air measurement tool. In their article, "Which Is A Better Metric For Measuring Airtightness: ACH @ 50 Pa Or CFM/ Ft² Of Surface Area @ 50

Pa?", which is adapted and added to in this reason statement, we get the basis of the argument for the introduction of a new metric into the International Energy Conservation Code for the measurement of air leakage.

To paraphrase, when measuring the airtightness of a building the objective is to learn how much leakage is occurring across the building's enclosure area. It is analogous to moisture permeability or the measurement of moisture across the building's enclosure area and thermal transmittance, the rate at which heat is transferred across the building enclosure area. The rate of air leakage or tightness does not depend on the volume of the structure as defined by the building's enclosure area but does depend on the holes associated with the surface area of the structure. Air permeability of a material is typically measured as the flow per area at a given pressure difference across the material. U value measurements are similar. If we want a metric to use to measure the airtightness quality of construction of the exterior enclosure of buildings it makes sense to use a metric that equates flow to the size and number of holes in the building's thermal enclosure.

The article continues with an example to help demonstrate how volume is not proportional to surface area:

Comparison between ACH50 and CFM50/ft² for a 2000 ft² home at 3 ACH50

House Is 50 X 40 X 8

Volume = 16,000 ft³

Surface Area = 50 X 40 X 2 + 180 X 8 = 5440 ft²

CFM50 = (3 X 16000)/60 = 800 CFM

CFM50/ft² = 800/5440 = 0.147 CFM50/ft²

Increase height to 2 story at 3 ACH50

House Is 50 X 40 X 16 Volume = 32,000 ft³

Surface area = 50 X 40 X 2 + 180 X 16 = 6880 ft²

CFM50 = (3 X 32000)/60 = 1600 cfm

CFM50/ft² = 1600/6880 = 0.233 CFM50/ft²

In this example, when the volume is doubled, the surface area increased by 26%. And when the ACH50 stays the same, the CFM/ ft² of surface area increased by 58%. I have attached an Excel spreadsheet calculator that further defines the disconnect between ACH and CFM/ ft² of surface area to further elaborate the issue. In the attached calculator you can change the ratio of width and length of the building to see the effect on the resulting expressions of air leakage. An independent yet similar calculator can be found at this Residential Energy Dynamic link <http://www.residentialenergydynamics.com/REDCalcFree/Tools/AirLeakageMetrics>

The primary purpose of this code change proposal is to introduce the CFM/ft² of surface area metric into the code. Deciding on where to set the minimum allowable leakage rate is difficult largely due to the earlier volume and surface area discussion. Both tests are performed at a pressure differential of 0.2 inch water gauge (50 Pa), which is a the traditional residential testing pressure so an attempt was made to align the introduction of a CFM/ft² of surface area metric with the existing ACH50 metric of 3 and 5 air changes per hour. ACH being a volumetric measurement penalized small volume dwelling units so a decision was made to concentrate on a size range of dwellings between 2500 and 5500 square feet. By doing this and using the attached conditioned floor space to shell area calculator we were able to see that little variation occurred between ACH and CFM/ft² of surface area metric when changing the size ratio of the modeled house within this house size range. By rounding up, the proposal is using .17 CFM/ft² of surface area metric to align with 3 ACH and .28 CFM/ft² of surface area metric to align with 5 ACH. By using these numbers, small volume homes, while not having a volumetric penalty, are allowed to be a little more leaky and large volume homes must achieve just about the same level of tightness if not a slight bit more. As the average home size in the United States is approximately just less than 2500 square feet this code change proposals purpose of introducing a better measurement metric without removing the codes traditional measurement methodology, provid additional flexibility while maintaining similar stringency.

The Energy Conservatory suggests that the use of Air Changes per Hour at 50 Pa (ACH50) started approximately 60 years ago by researchers who were interested in ways to predict the natural infiltration rate of buildings, which at the time was most commonly measured in Air Changes per Hour. At the time air quality in buildings was being studied and the metric made sense. If a pollutant is released in a building, the time for the concentration to decay by a certain percentage depends on the infiltration measured in air changes per hour. The analysis of a tracer gas decay test gives a result in air changes per hour. So, when they started measuring airtightness, for use in estimating natural infiltration in air changes per hour, it made sense to use ACH50 as the metric.

However, as discussed earlier, two homes with the same volume can have very different surface areas and holes associated with the building enclosure area.

Value is gained by including a surface area-based metric in that air-sealing varies directly with the amount of surface area not the amount of volume in the dwelling. Two buildings can have surface areas that differs by 15%, but have the same volume and the current metric offers the same leakage allowance. Therefore, if the purpose of measuring air leakage is to determine something about the construction quality, air leakage rate, energy efficiency and building durability the metric should be associated with the flow of air through holes in the enclosure. To quantify these things ACH is the wrong metric. It does not tell you anything about the quantity and air leakage through holes in the building. Conversely, the CFM/ ft² of surface area metric concretely expresses the quantity of air leakage throught the building's exterior enclosure. When an enclosure is tight more energy is conserved as well as allowing better control and predictability of air flow, thermal flow, and moisture flow.

Many standards are now using square foot of enclosure area instead of ACH. Examples include EnergyStar, US Army Corp of Engineers, LEED, US Passive House and ASHRAE 62.2. This proposal is the first step to bring this better expression of air leakage into the code. It has been created in such a way that options are maintained allowing jurisdictions and building professionals flexibility in defining air leakage requirements.

Link to Energy Conservatory article from which portions of this reason statement have been added:

<https://support.energyconservatory.com/hc/en-us/articles/204176240-Which-is-a-better-metric-for-measuring-airtightness-ACH-50-Pa-or-CFM-ft-of-surface-area-50-Pa->

Cost Impact: The code change proposal will not increase or decrease the cost of construction There should be no cost implication associated with the adoption of this proposed language. Dwellings will continue to need to be tested and testing prices will not change due to an additional option for how to express the results of the test.

RE92-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R303.4 Mechanical ventilation. Where the air infiltration rate of a *dwelling unit* is 5 air changes per hour or less or equal to 0.28 cubic feet per minute per square foot of dwelling unit enclosure area or less where tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the *dwelling unit* shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The Building ~~Each dwelling unit~~ shall be provided with ~~mechanical~~ ventilation that complies ~~.The mechanical ventilation system shall comply~~ with the requirements of the International Residential Code or International Mechanical Code , as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Committee Reason: The proposal as modified adds a better option that opens up opportunity for improved energy efficiency. The modifications bring in the detailed requirements is necessary to make this proposal work, and add another metric that is needed for this code change (Vote: 9-2).

Assembly Action:

None

RE92-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4 (IRC N1102.4), (New)

Proponents:

Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David A Eisenberg, DCAT, representing DCAT

(strawnet@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R402.4 (IRC N1101.6) (IRC N1102.4) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

DWELLING UNIT ENCLOSURE AREA. The sum of the areas of ceiling~~s~~, floors, and walls ~~that separating~~ separate the conditioned space of a dwelling unit's conditioned space from the exterior, or from its adjacent conditioned or unconditioned spaces, and adjacent dwelling units and common spaces. ~~Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above.~~

Commenter's Reason: This public comment does the following:

- Changes the definition of the term "dwelling unit enclosure area" to be consistent with the source definition in ASHRAE 62.2-2016 and that definition's intent.
- Removes ambiguous language from the proposal's definition while retaining its intent, as understood through communication with the proposal's team members.
- The word "or" is replaced with the word "and", with input from ICC staff. "And" is clearly the intent, where all of the included adjacency situations are meant to be included in calculating the dwelling unit enclosure area, not only any one of them. "And" is also the word used in the source definition.
- Strikes the last sentence in the proposal's definition because that sentence is not in the source definition and because the vertical dimension used to determine wall area is self evident.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This public comment only corrects a section number and clarifies a definition. Section number corrections and clarifications do not affect the cost of construction.

Public Comment# 1961

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved. The Committee recommended approval of both RE88 and RE92. The two proposals are inconsistent as to values and application. We have proposed a modification to RE88, which is intended to reconcile the differences between the two proposals by utilizing the more stringent cfm per square foot requirements of RE92 with the limited applicability of RE88 (applies to smaller homes and attached dwelling units). If RE88 is modified, then there is no need for RE92, as larger homes can simply meet the ACH50 standard and, as a result, RE92 should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1500

RE94-19

IECC: R402.4.1.3 (IRC N1102.4.1.3) (New)

Proposed Change as Submitted

Proponents: Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

R402.4 Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.2 Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Add new text as follows:

R402.4.1.3 (IRC N1102.4.1.3) Testing Garage Separation. The integrity of the air barrier assembly between dwelling units and attached garages shall pass a two-part test.

1. While conducting the air leakage test as described in Section R402.4.1.2 the air barrier separation between the house and the garage shall be tested to ensure that the house in reference to the garage is ≥ 45 Pascals of pressure when the house is held at 50 Pascals of pressure in relation to outside. All operable garage openings to the outside shall be closed during the test.
2. If test number 1 passes, the test shall be performed a second time with the garage vehicle door open to the ambient outside. The two test results shall not differ by more than 6 percent.

Reason: The energy code, like all code, is about health, safety, comfort, durability, as well as efficiency. The garage is the largest potential source of pollutants and carbon monoxide in the house and it has been codified in table R402.4.1.1 to ensure that the air in the garage is separated from the house. Air from an attached garage can enter the living space of the home if there are bypasses in the air barrier between the two spaces and if the home is at a negative pressure with respect to the garage. Negative pressures may be due to natural forces or to mechanical depressurization of the house with respect to the garage caused by appliances like rangehood fans, clothes dryers, bath fans, crawlspace ventilation or whole house ventilation systems, as well as, unbalanced HVAC systems. Unfortunately, there is no way to be sure that separation has been achieved, in this location, unless the separation is tested. Fortunately testing for separation between the house and garage is simple and is made even more practical due to the requirement to blower door test for every home.

The surest way to keep garage pollutants out of the house is to build a detached garage. Since most houses are designed with attached garages, planning ahead of construction to make sure a continuous air barrier is installed between the house and the garage makes sense. This proposal will promote such planning.

To ensure that there is not a false positive result Building America research has determined that the test requires two steps. First, while the house is at 50 Pascals of pressure with regards to outside during the blower door test a zonal pressure test is performed by installing a tube between the house and the garage. (Usually under the door between the house and the garage) If the garage is clearly outside, the measurement between the house and the garage should also be 50 Pascals of pressure. The closer the measurement is to zero the more connected the garage is to the house. This code proposal requires that the results of the first test be ≥ 45 pascals which is an indication that the air barrier assembly between the house and garage is sound. The first test is performed when all openings between the garage and the outside are closed. Second, this test is repeated with the overhead vehicle door open. If the results of the second test are greater than 6% the connection between the house and the garage tests fails. The rationale for the second test is to guard against false positive results that can occur while performing the first test.

If we continue to require separation between the house and the garage from an energy efficiency perspective, we must also test to ensure it from a

health and safety perspective in order to maintain the intent of the IECC. Programs such as the EPA Indoor Air Plus and the DOE Zero Energy Ready Home program have incorporated the protocol described above to test for this separation. In addition, Jurisdictions around the country, such as Fort Collins Colorado have amended the IECC to require this test as they realize the energy and health and safety implications.

People have asked if garage separation is really an issue. Past research, as pointed out in the Building America Program research paper titled "Air Leakage and Air Transfer between Garage and Living Space" says yes. An excerpt of a study done by S.J. Emmerich used in the Building America paper, reports that polluted garage air infiltrated into living quarters was as much as 45% of total house infiltration. See the attached research paper for more evidence of carbon monoxide and other pollutants traveling between attached garages and the house and the bibliography of numerous studies that have documented that pollutants from the garage are capable of migrating into the house.

The problem is that one cannot know for sure if the garage is connected to the house unless one tests. The complexities of the assemblies separating the house and the garage, with dropped ceilings, pipe, ducts, wiring and who knows what else penetrating the buildings thermal envelope and air barrier systems, make it an extremely difficult part of the house to seal. What we do know is that automobiles are the largest source of carbon monoxide in our home and they are parked in attached garages. We also know that other pollutants such as gasoline, pesticides, and paints are stored in attached garages. Therefore, to not test is clearly against the health and safety intent of the code and ultimately places builders and homebuyers at risk.

Resources:

US Department of Energy Building Technologies Office

Building America Program

"Air Leakage and Air Transfer between Garage and Living Space"

Armin Rudd Building Science Corporation

September 2014

Air Sealing and Insulating Garage Walls - Code Compliance Brief

<https://basc.pnnl.gov/code-compliance/air-sealing-and-insulating-garage-walls-code-compliance-brief>

Overview:

The intent of this brief is to provide code-specific information about air sealing and insulating garage walls to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for code officials on how to plan reviews and conduct field inspections can help builders or remodelers with proposed designs and installations and provide jurisdictional officials with information for acceptance. Providing the same information to all interested parties (e.g., code officials, builders, designers, etc.) is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

As in other parts of the home, sealing and insulating the walls and ceiling of your garage can be an effective way to improve energy efficiency in a home. In addition, properly isolating and air sealing attached garages from the living space is critical for preventing the potential infiltration of carbon monoxide and other contaminants into the home. Open joist bays above the garage that extend into living spaces need to be blocked and air sealed at the garage wall. Seams along the rim joist, top plate, sill plate, and foundation wall should be caulked or sealed. If there is living space above the garage, extra care should be taken to seal all seams and any holes in the subfloor, and any doors between the house and the garage should be weather stripped and have a tight-fitting threshold sweep.

Insulation and air-sealing requirements for garage walls shared with conditioned space are found in the International Energy Conservation Code (IECC) and International Residential Code (IRC). Even though each version of the 2009, 2012, and 2015 IECC/IRC codes has included provisions that the *building thermal envelope*¹ should be durably sealed to limit infiltration, the language related to air barriers and insulation in the 2009 version was somewhat vague and did not specify specific components of the *building thermal envelope*. The 2012 IECC/IRC added more specific language regarding areas of the *building thermal envelope* that should be sealed and expanded upon those areas that are now included in the 2015 IECC/IRC as well. This brief provides an overview of the 2009 through 2015 IRC/IECC code requirements related to air sealing and insulating attached garage walls.

Cost Impact: The code change proposal will increase the cost of construction

The cost implication of this proposal is small as this test must be performed at the same time as the blower door test described in section R4052.4.1.2. The garage separation test will add approximately 15 minutes to the testing that is already being performed so may add between \$25 and \$50. If the test fails it is an indication that already required code air sealing scopes of work are not being performed properly. This should require greater attention to detail rather than additional cost from the air sealing contractor.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Testing the integrity of the wall for separation of garage and living area air is not an energy code issue, it is an IRC issue (Vote: 9-2).

Assembly Action:

None

RE94-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Submitted

Commenter's Reason: Public Comment Reason Statement

I don't agree with the committee that the separation of the house and garage is solely an IRC issue. It is also an IECC issue as the integrity of the air barrier is critical in this location and air barriers are primarily discussed in the IECC, not the IRC. Garage Separation is addressed in the IECC in table R402.4.1.1 and floors over garages are addressed in other areas to ensure that a tight house is built and separation is created. This proposal quantifies what separation means, as it is, in its essence, why the IECC is also a health and safety code that needs to be taken as seriously as any other code and why many proposals at the CAH sought to address life safety in the IECC intent statement of Section R101.3.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The cost implication of this proposal is small as this test must be performed at the same time as the blower door test described in section R4052.4.1.2. The garage separation test will add approximately 15 minutes to the testing that is already being performed so may add between \$25 and \$50. If the test fails it is an indication that already required code air sealing scopes of work are not being performed properly. This should require greater attention to detail rather than additional cost from the air sealing contractor.

Public Comment# 1903

RE95-19

IECC: R402.4.1.3 (IRC N1102.4.1.3) (New), R402.4.1.3.1 (IRC N1102.4.1.3.1) (New), R402.4.1.3.2 (IRC N1102.4.1.3.2) (New)

Proposed Change as Submitted

Proponents: Aaron Gary, Tempo Partners, representing Self (aaron.gary@tempopartners.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.4.1.3 (IRC N1102.4.1.3) Sampling options for R2 multifamily dwelling units. For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Section R402.4.1.2. Prior to beginning sampling for testing, "Initial Testing" is required for each multifamily property. "Initial Testing" shall consist of the 3rd party testing contractor performing the required tests on at least three consecutive dwelling units. Test results from the "Initial Testing" must satisfy minimum code requirements before sampling is permitted. Dwelling units selected for the "Initial Testing" must be within the same building. Dwelling units selected for "Initial Testing" shall not be included in a "sample group" or counted toward the minimum 15% of dwelling units tested. The building official shall randomly select the three dwelling units for "Initial Testing." The building official may delegate the random selection to the designated 3rd party testing contractor.

R402.4.1.3.1 (IRC N1102.4.1.3.1) Sample group Identification and Sampling. The builder shall identify a "sample group" which may be a building, floor, fire area or portion thereof. All of the dwelling units within the "sample group" must be at the same stage of construction and must be ready for testing. The building official shall randomly select at least 15% of dwelling units from each "sample group" for testing. The building official may delegate the random selection to the designated 3rd party testing contractor.

If each tested dwelling unit within a "sample group" meets the minimum code requirements, then all dwelling units in the "sample group" are considered to meet the minimum code requirements.

Before a building may be deemed compliant with the testing as required, each "sample group" must be deemed compliant with the minimum code requirements. The sum total of all of the tested dwelling units across all "sample groups" shall not be less than a minimum of 15% of the dwelling units in a building.

R402.4.1.3.2 (IRC N1102.4.1.3.2) Failure to Meet Code Requirement(s). If any dwelling units within the identified "sample group" fail to meet a code requirement as determined by testing, the builder will be directed to correct the cause(s) of failure, and 30% of the remaining dwelling units in the "sample group" will be randomly selected for testing by the building official, or third-party testing contractor, regarding the specific cause(s) of failure.

If any failures occur in the additional dwelling units, all remaining dwelling units in the sample group must be individually tested for code compliance.

A multifamily property with three failures within a 90-day period is no longer eligible to use the sampling protocol in that community or project until successfully repeating "Initial Testing." Sampling may be reinstated after at least three consecutive dwelling units are individually verified to meet all code requirements.

A Certificate of Occupancy may not may be issued for any building until testing has been performed and deemed to satisfy the minimum code requirements on the dwelling unit(s) identified for testing.

Reason: For many multifamily (R2 classifications) projects, it is very costly and time consuming to test each dwelling unit for projects where there may be dozens of dwelling units in each building. Considering that the same tradesman generally constructs a building, it is reasonable to deem that construction practices are consistent and that if a reasonable sampling of units tested pass then all units would pass. These amendments (originally drafted by the North Texas Council of Governments Energy and Green Advisory Board) or are very similar ordinances, have been accepted across Texas by the EHJs including the City of Dallas, the City of Austin, and the City of San Antonio.

Cost Impact: The code change proposal will decrease the cost of construction

This code change proposal will streamline the cost and time required to conduct on-site verification of Code which will result in lower testing costs and faster construction timelines.

RE95-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The sampling criteria as it is written is not code-ready (Vote: 7-4).

Assembly Action:

None

RE95-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R402.4.1.3 (New)

Proponents:

Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

R402.4.1.3 Sampling for multifamily dwelling and sleeping units. Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, additional units shall be tested, including a mixture of testing unit types and locations.

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Commenter's Reason: The reason statement for disapproval given by the Committee was that, "The sampling criteria as it is written is not code-ready." The revised language proposed achieves the same intent of the original proposal but using better code-ready language. This revised sampling language was overwhelmingly approved by the Commercial Energy Committee for the testing of multifamily dwelling units.

Bibliography: 2019 REPORT OF THE COMMITTEE ACTION HEARINGS ON THE 2018 EDITIONS OF THE GROUP B INTERNATIONAL CODES

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This replacement proposal streamlines the time required to conduct on-site testing which will translate to better compliance and faster construction timelines.

Public Comment# 2062

Public Comment 2:

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests As Submitted

Commenter's Reason: This proposal helps to establish a sampling protocol and gives direction to verifiers and code officials on how sampling is to be done. It is over burdensome to require testing of all units in multifamily dwellings – some jurisdictions around the country are already allowing sampling to be done and this protocol gives directions and guidance on how these measures should take place. This proposal has mechanisms in place for when failures occurs and how to handle those appropriately.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This proposal would help decrease the cost of construction. If a sampling protocol is in place then every unit would not need to be tested which would save builders and developers money and third party inspectors the time that it takes to test every unit.

Public Comment# 1417

RE102-19

IECC: R402.4.1.2.1 (IRC N1102.4.1.2.1) (New)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Add new text as follows:

R402.4.1.2.1 (IRC N1102.4.1.2.1) Multi-unit buildings and single family attached buildings Multi-unit buildings and single family attached buildings shall be tested as a single zone, multiple zones, or as individual dwelling units in accordance with ASTM E779.

Reason: This proposal is very clear and straight forward, it helps to clarify testing in multi-unit buildings. The ASTM E779 standard is referenced in R402.4.1.2 and this standard allows for single, or multiple zone testing. This proposal is just adding clarification to the code for a method that is already allowed. Currently the IECC treats low -rise multifamily buildings of three stories or less like single-family homes and multifamily buildings of four stories or more like commercial buildings. Regardless of height, all multifamily buildings have the same airtightness testing complications to address. Large multiple dwelling buildings are often tested as isolated test zones due to the nature of the actual testing procedures and available equipment needed to depressurize large volumes of conditioned space and this proposal would recognize this challenge for those conducting the testing. By approving this proposal, low -rise multifamily buildings, two-unit dwellings and town houses will avoid these complications, but still be held to the same level of performance as high-rise (R-2) residential as well as commercial buildings

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not change the cost of construction. It is adds clarification to something that is already allowed in the code.

RE102-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This adds more options (Vote: 6-5).

Assembly Action:

None

RE102-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4.1.2.1 (IRC N1102.4.1.2.1) (New)

Proponents:

Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.4.1.2.1 (IRC N1102.4.1.2.1) Multi-unit buildings and single family attached b ~~Multi-unit buildings and single family attached buildings~~ **Buildings other than detached one-family dwellings** Multi-zone unit buildings, and two-single family dwellings, and townhouses attached buildings shall be tested as a single zone, without inducing equal pressures in adjacent zones, multiple zones, or shall be tested as individual dwelling units in accordance with ASTM E779.

Commenter's Reason: NAHB seeks to clarify air-leakage testing in multi-unit buildings (ie. low-rise apartment bldg., townhouses, 2-family), which is allowed at the building or dwelling unit level. Section 1.4 of ASTM E779 states that "This test method is intended to be used for measuring the airtightness of building envelopes of single-zone buildings. For the purpose of this test method, many multi-zone buildings can be treated as single-

zone buildings by opening interior doors or by inducing equal pressures in adjacent zones."

There is indeed confusion in the industry about the last option, which is often called a "guarded test", where you can test a single dwelling unit while inducing equal pressures in adjacent spaces, which then effectively ignores leakage to/from those adjacent spaces. In apartment buildings, these adjacent spaces can be conditioned (other apartments, corridor) or unconditioned (stairwell, trash chute, elevator shaft, vacant apartment). Approving this code change proposal (RE102) would explicitly allow a test that ignores air leakage from those spaces, meaning a dwelling unit can be code compliant, yet have significant energy losses due to the air leakage to/from those spaces.

Additionally, the proponent didn't offer a different air leakage rate for units using this test, meaning a single family detached home might be limited to 900 CFM50 of leakage when testing the entire envelope, whereas an attached unit of the same size gets the same exact leakage allowance, but is only counting air leakage through 20-50% of its envelope. They stated that their proposal would hold these buildings "to the same level of performance as high-rise (R-2) residential as well as commercial buildings", but that isn't the case since in commercial, that test is pro-rated based upon the envelope surface area, not volume.

While NAHB indicates that this test option should result in needing less equipment than the single-zone building test and is somehow less complicated, a dwelling unit test only requires one blower door. Simple! It generally requires 6-9 (or more!) simultaneously running blower doors to establish equal pressures in the adjacent zones. That is much more complicated! It's actually not the test procedures that are complicated. What is happening in practice is that when a dwelling unit fails to meet the required ACH50, the expense of this test is incurred rather than fixing the airtightness of the dwelling unit, since this test procedure allows the failure to remain. While ASTM E779 is an approved standard, it is very difficult for code officials to verify that all the procedures of ASTM E779 have actually been followed, let alone this specific test option.

This public comment seeks to provide the clarity that is in fact needed, but without providing a loop-hole around meeting the air leakage test requirement in R402.4.1.2. Other options have been proposed with NAHB's support (RE88, RE92, RE96) that provide builders of attached housing the appropriate flexibility they need to overcome the understandable challenges of meeting the air leakage rates, without sacrificing energy efficiency. Those proposals were met with much more support than RE102, which was barely approved by the Committee with a vote of 6-5. Supporting RE102 As-Submitted explicitly allows multi-zone testing in the code which undermines the purpose of the air leakage test. Supporting RE102 As-Submitted also inadvertently removes the option to test in accordance with the other 2 approved referenced standards (RESNET/ICC 380 and ASTM E1827).

This public comment also improves the original proposal by using defined terms and avoiding the redundant reference to the standards, which is already part of R402.4.1.2

I urge your support of this public comment or my other public comment for Disapproval of RE102. For context, I am a mechanical engineer, not a code official or a builder. I have worked for a building science consulting firm since 2005, primarily in support of energy efficient multifamily housing. My goal here is to help builders build energy efficient buildings.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The net effect of the code change proposal and the public comment is to disallow a more expensive air leakage test option. It will not therefore increase or decrease the cost of construction.

Public Comment# 1866

Public Comment 2:

Proponents:

Gayathri Vijayakumar, Steven Winter Associates, Inc., representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests Disapprove

Commenter's Reason: While the Proponent had submitted a Floor Mod to add the missing referenced standards (RESNET/ICC 380, ASTM E1827) that are approved for use currently in R402.4.1.2, the Committee's vote was "As Submitted" and not "As Modified". Therefore, the version approved by the Committee, which is the original proposal, must now be Disapproved as it limits multi-unit and single family attached buildings from using these other Standards which are approved for conducting the air leakage test. ANSI/RESNET/ICC 380-2019 actually has procedures specific to this type of attached housing and is a better referenced standard for that reason. As the Committee's rationale for approving 'As Submitted' was that "This adds more options", their approval of the non-modified version actually LIMITS the options available. Additionally, explicitly allowing multi-zone testing in the code undermines the purpose of the air leakage test. If multi-zone testing (ie. guarded testing) is to be permitted, the leakage permitted would need to be adjusted as well. Attached units using multi-zone testing are just measuring leakage through the walls/floors/ceilings exposed to the outdoors. This is an acceptable test, but they cannot have the same leakage allowance as a detached home testing leakage through its entire envelope.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

RE106-19

IECC: R403.1.1 (IRC N1103.1.1)

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Revise as follows:

R403.1.1 (IRC N1103.1.1) Programmable thermostat. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of ~~controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day, providing a 5:2 (weekdays:weekends) programmable schedule, and at least 2 programmable schedules per day.~~ This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C).

Reason: This code change clarifies the intended operational capability of programmable thermostats by distinguishing between weekday and weekend occupancy schedules along with at least 2 programmable schedules per day. The change also accounts for the capabilities of smart thermostatic controls that auto-adjust based on daily and weekly occupancy patterns. Finally, the manufacturer's initial programmed setting requirement is deleted.

This proposal is submitted by the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at: <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx> (<http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>)

Cost Impact: The code change proposal will increase the cost of construction

This requirement will increase costs for the subset of buildings not currently constructed with weekday:weekend programmable thermostats.

RE106-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is not solving anything that is not standard and the language confuses the requirement (Vote: 7-4).

Assembly Action:

None

RE106-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.1.1

Proponents:

Anthony Floyd, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.1.1 Programmable thermostat. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day and week providing a 5:2 (weekdays:weekends) programmable schedule, and at least 2 programmable schedules per day. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C).

Commenter's Reason: This code change clarifies the intended operational capability of programmable thermostats by accounting for the day(s) of the week that the dwelling occupancy regularly deviates from the typical day such as on weekends. This change accommodates temperature settings based on not just the time of day but also the day of the week.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment only provides clarification to existing operational requirements. Clarifications to the code do not impact the cost of construction.

Public Comment# 1870

RE107-19

IECC: R403.1.3 (N1103.1.3) (New), R403.10.1 (1103.10.1)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

Add new text as follows:

R403.1.3 (IRC N1103.1.3) Continuously Burning Pilot Lights The natural gas systems and equipment listed below are not permitted to have continuously burning pilot lights:

1. Fan-type central furnaces.
2. Household cooking appliances.

Exception: Household cooking appliances without electrical supply voltage connections and in which each pilot light consumes less than 150 Btu/hr.

3. Pool heaters.
4. Spa heaters.
5. Fireplaces.

Revise as follows:

R403.10.1 (N1103.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. ~~Gas-fired heaters shall not be equipped with continuously burning ignition pilots.~~

Reason: Standing pilot lights are no longer necessary with many gas-fired appliances offering alternative ignition methods. Some models rely completely on intermittent ignition, while others allow standing pilots to operate for a few hours after shutdown and then use electronic ignition to re-start. This proposal saves energy by eliminating the wasted energy of a pilot light during the numerous hours per year when the appliance is non-operational.

Cost Impact: The code change proposal will increase the cost of construction

This prohibition is not expected to add significant cost to any gas-fired appliance listed in the proposal. Past efficiency studies have shown \$100 increase in price for fireplaces in particular to move from a standard continuously lit pilot light to an intermittent ignition system.

RE107-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent asked for disapproval to provide time to work with opposition (Vote: 11-0).

Assembly Action:

None

RE107-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R202 (New), R403.1.3 (IRC N1103.1.3) (New), R403.10.1 (N1103.10.1)

Proponents:

Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

Modify as follows:

2018 International Energy Conservation Code

R202 Continuously Burning Pilot Light A small gas flame used to ignite gas at a larger burner. Once lit, a continuous pilot light remains in operation until manually interrupted.

R403.1.3 (IRC N1103.1.3) Continuously Burning Pilot Lights The natural gas systems and equipment listed below are not permitted to have continuously burning pilot lights:

- 1.Fan-type central furnaces.
- 2.Household cooking appliances.

Exception:Household cooking appliances without electrical supply voltage connections and in which each pilot light consumes less than 150 Btu/hr.

- 3.Pool heaters.
- 4.Spa heaters.
- 5.Fireplaces.

R403.10.1 (N1103.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. ~~Gas-fired heaters shall not be equipped with continuously burning ignition pilots.~~

Commenter's Reason: Public comment adds a definition of a continuously burning pilot light to clarify what "continuous" means based on feedback from the industry. In addition, while continuous pilot lights for pool and spa heaters are already banned by the IECC, this new section R403.1.3 will cover all cases where they are banned and therefore we have removed the additional reference to continuously burning pilot lights in section R403.10.1 to avoid duplicate information.

Original reason statement: Standing pilot lights are no longer necessary with many gas-fired appliances offering alternative ignition methods. Some models rely completely on intermittent ignition, while others allow standing pilots to operate for a few hours after shutdown and then use electronic ignition to restart. This proposal saves energy by eliminating the wasted energy of a pilot light during the numerous hours per year when the appliance is nonoperational.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Original cost statement: This prohibition is not expected to add significant cost to any gas-fired appliance listed in the proposal. Past efficiency studies have shown \$100 increase in price for fireplaces in particular to move from a standard continuously lit pilot light to an intermittent ignition system. Other gas-fired appliances on the prohibition list have largely moved away from continuous pilots and intermittent ignition systems do not add substantial cost to the final product.

RE109-19

IECC: R403.3 (IRC N1103.3), R403.3.1 (IRC N1103.3.1) , R403.3.7 (IRC N1103.3.7)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R403.3 (IRC N1103.3) Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through ~~R403.3.7~~ R403.3.6.

~~**R403.3.1 (IRC N1103.3.1) Insulation (Prescriptive).** Supply and return ducts in attics shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.~~

~~**Exception:** Ducts or portions thereof located completely inside the *building thermal envelope*.~~

~~**R403.3.7 (IRC N1103.3.7) R403.3.6 (IRC N1103.3.6) Ducts located in conditioned space, and insulation.** For ducts Duct work located outside conditioned space, shall be insulated to an *R*-value of not less than R-8. For duct work to be considered as inside a conditioned space, such ducts it shall comply with either one of the following:~~

1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
2. ~~The ducts shall~~ Duct work in ventilated attic spaces shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:
 - 2.1. The air handler is located completely within the *continuous air barrier* and within the building thermal envelope..
 - 2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m²) of conditioned floor area served by the duct system..
 - 2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.
3. Duct work in floor cavities located over unconditioned space shall have a continuous air barrier on all six sides of the floor cavity and insulation installed in accordance with section R402.2.8 with the addition of insulation fully surrounding the duct and uncompressed R-19 insulation below, or duct work installed in a floor cavity that is insulated per the exception in section R402.2.8..
4. Duct work located within exterior walls shall have a continuous air barrier on all six sides of the wall cavity, a minimum R-10 insulation separating the entire duct from the outside sheathing of the cavity, and the remainder of the cavity insulation fully surrounding the duct to the drywall side.

Reason: Ductwork insulation is dependent on its location. This proposal addresses this issue. By removing Section R403.3.1 Insulation, and combining it with section R403.3.7 duct location, the code becomes more understandable and useable for field practitioners. This newly edited section requires that all duct work located outside of conditioned space regardless of size be insulated to an R-8. This minimum R-value duct insulation is widely available and important to have on ducts located outside regardless of the climate zone in which it is installed or the size of the duct. In addition, it is already the required R-value for duct work located outside per the existing section R403.3.1 As Allison Bailes points out in his Energy Vanguard blog post titled, "The invisible problem with duct insulation" The delta T across the insulated surface can be huge when ducts are located outside the conditioned space. (<https://www.energyvanguard.com/blog/invisible-problem-duct-insulation>) In his example ducts located in the attic experienced a delta T of 62°. Although it would be good to raise the minimum required R-value associated with ducts located outside the conditioned envelope this proposal instead incentivizes installation techniques that drive the performance of the duct to be more like that of ducts installed completely inside.

By defining the three possible locations where ductwork can be installed and how to address the insulated assembly so the duct can be considered to be inside conditioned space this proposal increases the energy performance of homes. The three possible locations for duct installation are, one, completely inside the continuous air barrier assemblies, two, completely outside the continuous air barrier assemblies, or three within the continuous air barrier and building thermal envelope assemblies. In the last code cycle, the addition of section R403.3.6 Ducts buried within ceiling insulation addressed the insulation installation issue for ducts located outside of the continuous air barrier assemblies. This code cycle, the hope is that ducts located within the continuous air barrier and building thermal envelope assemblies will be addressed.

The last detail to point out is an energy code compliance issue when using section R405 Simulated Performance Alternative and section R406 Energy Rating Index compliance paths. These pathways include duct location in the software modeling. It has not been clear until the 2018 IECC how to model buried ductwork and the hope now is that the additional language in this proposal will clarify how to model duct work that is installed within the continuous air barrier and building thermal envelope assemblies. If it is installed per this code change proposal it can be considered to be within conditioned space.

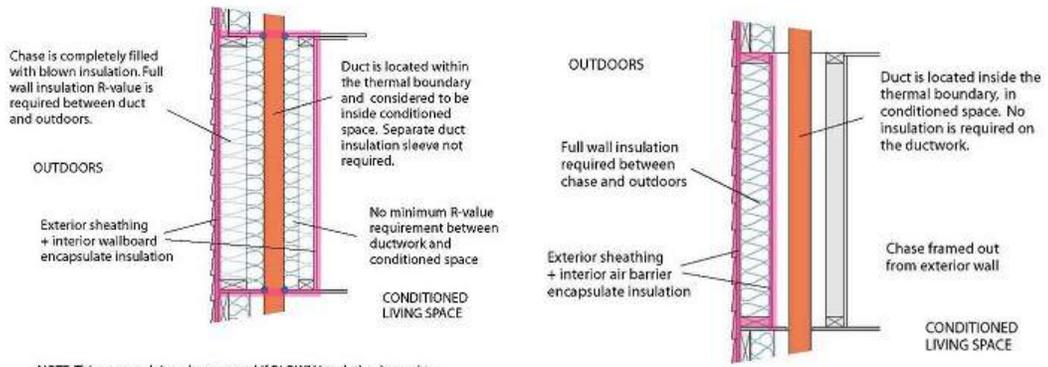
See example diagrams for examples of how insulation of duct work installed within the building thermal envelope assembly could be achieved in

order to locate them within the conditioned space.

The following diagrams illustrate example installations of duct work in garage floor systems or in exterior walls that would be considered to be within the conditioned space.

Example of Ducts in Exterior walls that would be considered within the conditioned space

Duct chase on exterior wall - Solution 2 Duct chase on exterior wall - Solution 1



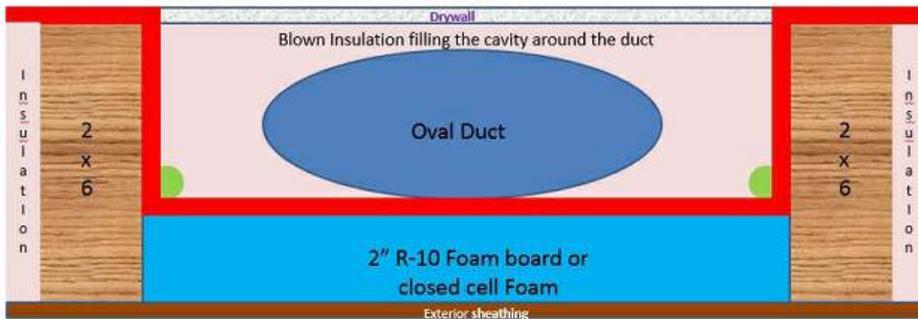
NOTE: This approach is only approved if BLOWN insulation is used to completely fill the chase.

3/19/2012

3/19/2012

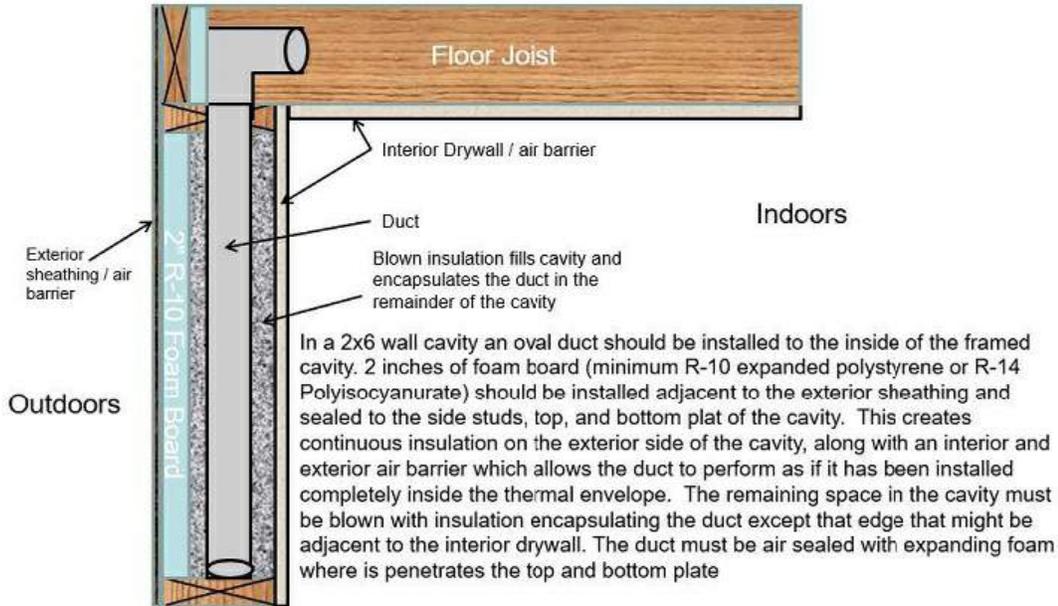
Duct riser in a 2x6 exterior wall

- Line of the interior air barrier now brings duct into conditioned space
- Foam board must be sealed in place at connections to wood framing. Foam board should be installed at the rim joist were the duct riser transitions to with an elbow to a boot or floor run.
- It is usual to upsize to a 7" oval to accommodate the flow of a 6" round design run.
- Seal duct penetration through top and bottom plat

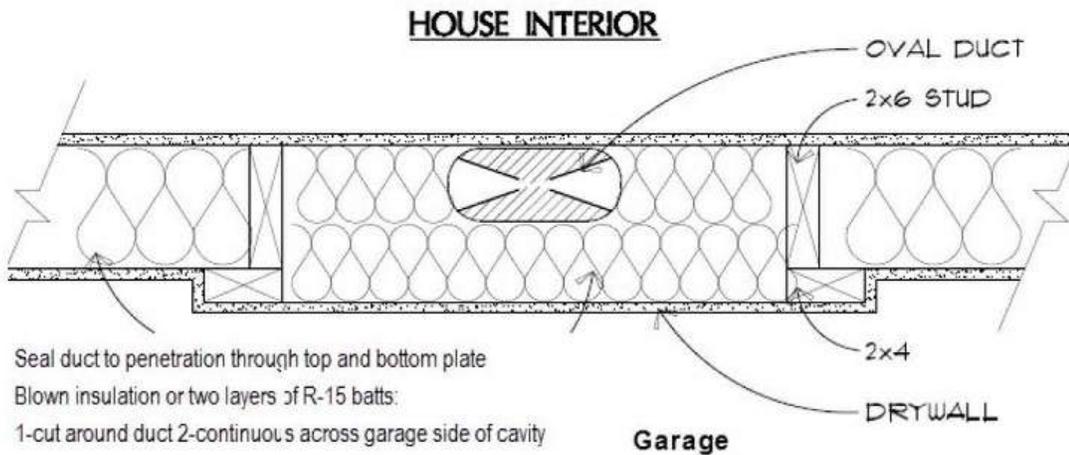


Supply Duct Riser in an Exterior Wall – Solution 3

For situations where a wall cannot be bumped out into the conditioned space of the home:

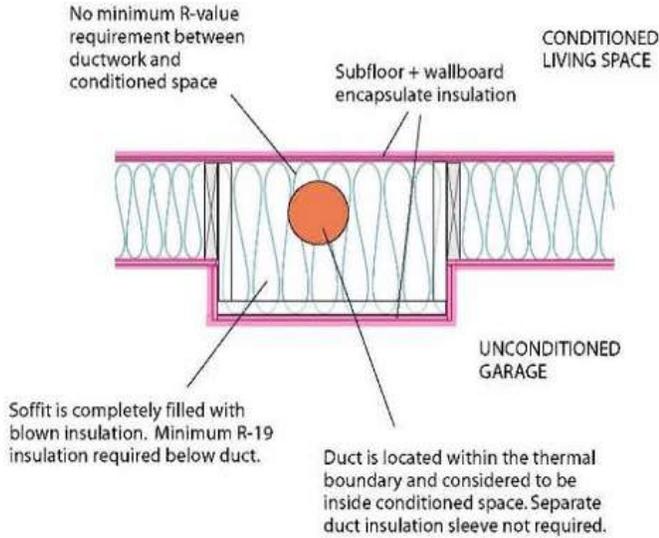


Example of Duct in wall between house and garage



Example of Duct in floor system that would be considered within the conditioned space.

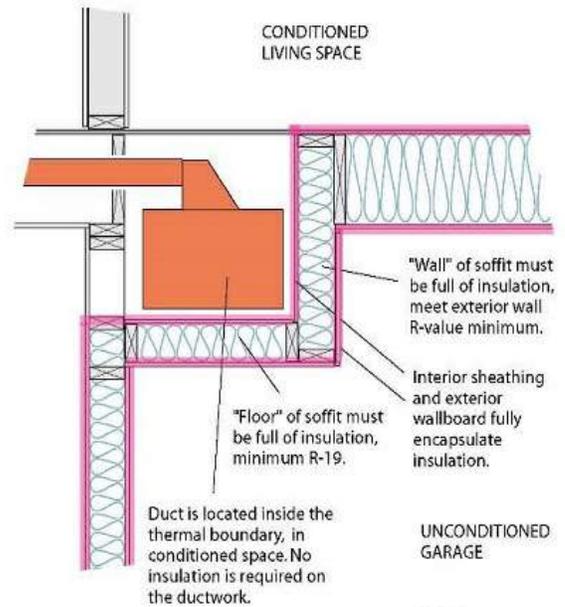
Ductwork in floor over garage



NOTE: This approach is only approved if BLOWN insulation is used to completely fill the soffit.

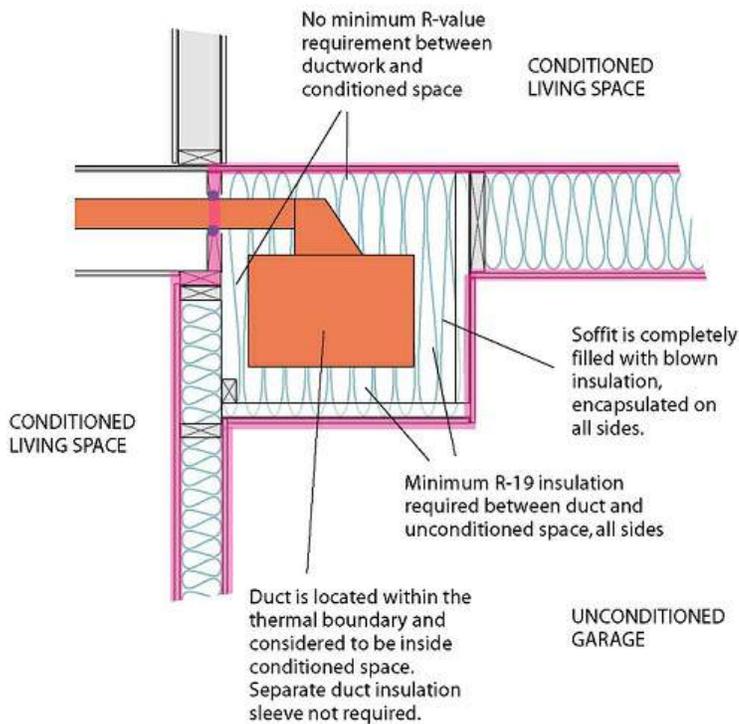
3/19/2012

Ductwork in garage soffit, adjoining conditioned space, living space above - Solution 2



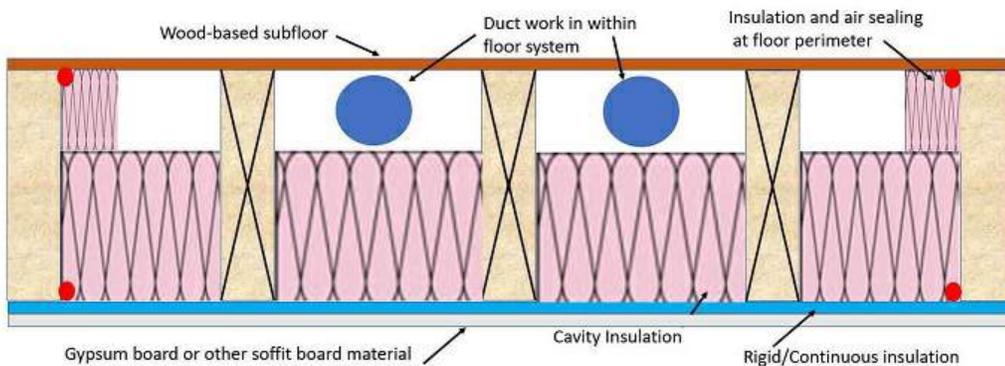
3/19/2012

Ductwork in garage soffit, adjoining conditioned space, living space above - Solution 1



NOTE: This approach is only approved if BLOWN insulation is used to completely fill the soffit.

3/19/2012



Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal provides new installation guidance and a definition of when a duct is considered to be inside conditioned space that will increase the energy efficiency of a house with better insulated ducts when installed within the continuous air barrier and building thermal envelope assemblies. Ductwork must be insulated and installed per manufacturer instruction. Also, insulation currently must fully surround obstructions like ductwork that is installed in a cavity. So, no additional cost should be expected with the approval of this proposal.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The concept is needed but the language is confusing and it could appear that you must bury ducts. Needs to come back with improved language. The change from R6 to R8 is significant and not addressed (Vote: 10-1).

Assembly Action:

None

RE109-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.3 (IRC N1103.3), R403.3.1, R403.3.7 (IRC N1103.3.7)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.3 (IRC N1103.3) Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through ~~R403.3.6~~ R403.3.7

R403.3.1 Insulation (Prescriptive). Supply and return ducts located outside conditioned space shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter.

R403.3.76 (IRC N1103.3.7) Ducts located in conditioned space, and insulation. ~~Duct work located outside conditioned space, shall be insulated to an *R*-value of not less than R-8.~~ For duct work to be considered inside conditioned space, it shall comply with one or more of the following:

1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
2. Duct work in ventilated attic spaces shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:
 - 2.1. The air handler is located completely within the *continuous air barrier* and within the building thermal envelope..
 - 2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m²) of conditioned floor area served by the duct system..
 - 2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.
3. Duct work in floor cavities located over unconditioned space shall comply with all of the following:
 - 3.1. A continuous air barrier on all six sides of the floor cavity and insulation installed between unconditioned space and the duct.
 - 3.2. Insulation installed in accordance with Section R402.2.8 with the addition of insulation fully surrounding the duct and uncompressed R-19 insulation below, or duct work installed in a floor cavity that is insulated per the exception in Section R402.2.8
 - 3.3. A minimum R-19 insulation installed in the cavity width separating the duct from unconditioned space.

4. Duct work located within exterior walls of the building thermal envelope shall comply with the following:

4.1. ~~shall have~~ A continuous air barrier on all six sides of the wall cavity, a installed between unconditioned space and the duct

4.2. Minimum R-10 insulation installed in the cavity width separating the entire duct from the outside sheathing of the cavity, and

4.3 The remainder of the cavity insulations shall be fully surrounding the duct insulated to the drywall side.

Commenter's Reason: The committee agreed that the concept of being able to define ducts that are located within wall and floor cavities as either inside or outside the conditioned space of the home, based on how the air barrier and insulation is installed, is needed. They agreed that it is a logical extension of the buried duct concept, but they found some of the language confusing and wanted to clarify that it is not a requirement to burry ducts in ventilated attics, but rather it is a choice. To help clarify, the section language was changed to read, "R403.3.7 Ducts located in conditioned space". I believe that this new title makes clear that specific things need to occur with the installation of the duct to ensure that it will perform as if it is within the building's air barrier and thermal envelope. Other changes have been made to make the language and requirements more understandable. For example, the 2nd sentence was reworked to say, "For ductwork to be considered inside conditioned space, it shall comply with one of the following." This language ensures that all understand that the "following" must occur to determine that the ducts are inside the building. The installation requirements for ducts within floor and wall cavities have been adjusted to be more clear, concise, and ultimately more understandable. To clarify that only ducts installed in ventilated attics and want to be considered inside the building envelope and therefore need to be buried, the following language was added, "Ductwork in ventilated attic spaces...."

The committee also believed that there was a significant change in requiring R8 duct insulation vs. R6. I don't believe this is a significant change as the code currently states that R8 is required for 90% of the duct that is installed in unconditioned space. Section **R403.3.1 Insulation** states, "Supply and return ducts in attics shall be insulated to an *R*-value of not less than **R-8** for ducts 3 inches (76 mm) in diameter and larger and not less than **R-6** for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter." Therefore, when the duct is located in a ventilated attic and its size is greater than or equal to 3", it is required to be insulated to an R8. This proposal's only change is to require the few ducts that might be smaller than 3" to also be insulated to an R8.

Lastly, Section R403.3.1 regarding duct insulation has been added back in and changed to say, "Supply and return ducts located outside conditioned space in attics shall be insulated". Now, there should be no confusion regarding the fact that only ducts located outside must be insulated.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. First, it is optional to install the duct work so that it is considered to be in the conditioned space. Next, This proposal provides new installation guidance and a definition of when a duct is considered to be inside conditioned space that will increase the energy efficiency of a house with better-insulated ducts when installed within the continuous air barrier and building thermal envelope assemblies. Ductwork must be insulated and installed per manufacturer instruction. Also, insulation currently must fully surround obstructions like ductwork that is installed in a cavity. So, no additional cost should be expected with the approval of this proposal.

Public Comment# 1909

RE110-19

IECC: R403.3.2 (IRC N1103.3.2)

Proposed Change as Submitted

Proponents: David Bixby, Air Conditioning Contractors of America, representing Air Conditioning Contractors of America

2018 International Energy Conservation Code

R403.3.2 (IRC N1103.3.2) Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code , as applicable.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope* .

Reason: When ductwork is located inside a building's thermal envelope, any duct leakage from unsealed ductwork enters an already conditioned space within the building thermal envelope. Therefore, no energy loss occurs that is directly related to the sealed and/or unsealed air leakage through the building envelope and not by an unsealed duct in a conditioned space. Although sealing ductwork located inside the building's thermal envelope provides better comfort for the homeowner, it has no impact on energy efficiency or economic benefits. When discussing building energy efficiency and economic benefits, a homeowner should focus on reducing building leaks, better insulation, windows, and doors, as these are areas where building energy efficiency is lost at the building envelope, not by sealing ductwork in a conditioned space.

Cost Impact: The code change proposal will decrease the cost of construction

The proposal will potentially eliminate the need to seal ducts under the conditions specified in the exception, thus reducing the cost of construction in those situations.

RE110-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This would create excessive duct leakage (Vote: 11-0).

Assembly Action:

None

RE110-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

David Bixby, representing Air Conditioning Contractors of America (bixster1953@yahoo.com)

requests As Submitted

Commenter's Reason: ACCA requests approval of the proposal as submitted. The Committee's reason for rejection is that the proposed exception "would create excessive duct leakage." There is no "credible" scientific study that we are aware of that substantiates this. Such an unsubstantiated assertion is therefore a baseless and false assumption. If the ductwork is properly constructed (i.e., put together) according to IRC requirements, as verified by the code official, there should NOT be "excessive leakage" that requires additional sealing. Currently the IRC requires compliance with SMACNA/ANSI—2016: *HVAC Duct Construction Standards—Metal and Flexible* and SMACNA—10: *Fibrous Glass Duct Construction Standards*. The IRC also requires ducts to be designed to meet ACCA Manual D requirements, with each duct carefully sized to provide the airflow needed to meet room-by-room heat loss and heat gain calculations in accordance with ACCA Manual J. Problems with poor airflow are attributed to (1) improperly following ACCA Manual J so the calculated airflow is wrong, (2) improper ductwork design and installation, and/or (3) lack of commissioning and air balance. Excessive duct leakage is very rarely the cause of low or poor airflow. Commissioning and an air balance would show excessive duct leakage if it existed. When ductwork is inside a building's thermal envelope, any duct leakage from unsealed ductwork enters an already conditioned space within the building thermal envelope. Therefore, no energy loss occurs that is directly related to the sealed and/or unsealed air leakage through the building envelope and not by an unsealed duct in a conditioned space. Although sealing ductwork located inside the building's thermal envelope may provide better comfort for the homeowner, it has no impact on energy efficiency or economic benefits. When discussing building energy efficiency and economic benefits, a homeowner

should focus on reducing building leaks, better insulation, windows, and doors, as these are areas where building energy efficiency is lost at the building envelope, not by sealing ductwork in a conditioned space.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The proposal will potentially eliminate the need to seal ducts under the conditions specified in the exception, thus reducing the cost of construction in those situations.

Public Comment# 1990

RE112-19

IECC: R403.3.3 (IRC N1103.3.3), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

R403.3 (IRC N1103.3) Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.1 (IRC N1103.3.1) Insulation (Prescriptive). Supply and return ducts in attics shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope*.

R403.3.2 (IRC N1103.3.2) Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code, as applicable.

R403.3.2.1 (IRC N1103.3.2.1) Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

Revise as follows:

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions Exception:

- ~~1. A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.~~
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 8.0 cubic feet per minute (226.6 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Reason: The purpose of this code change proposal is to help ensure occupant comfort, proper heating and cooling system performance, and resulting long-term energy savings by requiring a duct leakage test for all new homes, including homes with all ducts inside conditioned space. This action will also help reduce the likelihood of builder callbacks for poorly-functioning, uncomfortable HVAC systems. The IECC currently exempts homes from duct testing requirements where the air handler and all ducts are located inside conditioned space. Although moving all ducts inside conditioned space may have a positive impact on energy efficiency overall, this practice alone cannot guarantee that the ducts will be tight enough to deliver conditioned air to all occupied areas of the home. Uncomfortable occupants commonly adjust thermostat settings to counteract the effect of poor delivery of conditioned air, leading to huge losses in energy efficiency. And these homes are at far greater risk for builder callback. This proposal will improve building quality and keep occupants more comfortable by requiring a duct test for all new homes, although the allowable leakage rate will be set at twice the prescriptive rate when all ducts are located inside conditioned space. Duct leakage rates can be extremely high when ducts are not tested. We do not believe that builders intentionally cut corners in duct sealing when

they know that the system will not be tested. However, without an objective test as a means of quality assurance, even careful builders may not be aware of missed connections or poor sealing. In a recent DOE field study of residential homes in Kentucky, homes received duct leakage tests even where all supply and return ducts were located inside conditioned space. The results were striking – **of the 24 homes tested (that would have qualified for the test exemption under the IECC), all 24 homes had higher leakage rates than the 2018 IECC requirement. Tested duct leakage for these homes averaged 18.5 cfm/sq.ft., with individual homes ranging from 6.26 cfm/sq.ft. to as high as 40.36 cfm/sq.ft.** See <https://www.energycodes.gov/compliance/energy-code-field-studies>. We note that 40 other homes in the same study were required to be tested (because at least some ducts were located outside conditioned space), and these homes achieved leakage rates of 9.7 cfm/sq.ft., on average – roughly half the leakage rate of homes that qualified for the exemption. Obviously, this is a small sample size, but the Field Studies found similar results in Pennsylvania, where “exempt” homes (with all ducts inside conditioned space) averaged almost 31 cfm/sq.ft. leakage, while homes required to be tested averaged almost 18 cfm/sq.ft. leakage.

Results of DOE Field Study Data Collection on Duct Tightness				
	Ducts in Conditioned Space (Exempt from Test)		Ducts Outside Conditioned Space (Testing Required)	
	Kentucky	# Samples	24	# Samples
Max Test Result		40.36	Max Test Result	18.90
Min Test Result		6.26	Min Test Result	3.10
Avg Test Result		18.46	Avg Test Result	9.71
Pennsylvania	# Samples	18	# Samples	52
	Max Test Result	77.10	Max Test Result	69.00
	Min Test Result	12.60	Min Test Result	2.44
	Avg Test Result	30.95	Avg Test Result	17.95

Although the results vary across the states sampled, these results point to a shortcoming in the IECC’s “complete exemption” approach to homes with all ducts inside conditioned space.

Although most energy modeling software does not capture the occupant-level impact of poorly-sealed ducts, anyone who has lived or worked in a building with leaky ducts understands that discomfort can lead occupants to adjust the thermostat. The energy impact of adjusting the thermostat is huge. The following table shows the increased energy use that results from adjusting the thermostat up or down a single degree in a code-compliant house in each climate zone.

Increased Energy Use Resulting from Thermostat Adjustment									
Measure	Weighted	1	2	3	4	5	6	7	8
+1 Degree Heating	4.1%	0.5%	3.0%	4.2%	4.4%	4.7%	4.5%	4.0%	2.9%
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

Obviously, if an uncomfortable occupant adjusts the thermostat 2 or 3 degrees, the impact will be far higher, and could essentially negate many of the efficiency gains made in the IECC over the last decade.

The concept of requiring a test for all new homes is not new. DOE’s Building America Program recommends that “[e]ven in conditioned space, ducts should be insulated to reduce the risk of condensation and mold. They should be tightly sealed and tested for leakage.” See https://www.energy.gov/sites/prod/files/2014/01/f6/1_1g_ba_innov_ductsconditionedspace_011713.pdf. Likewise, the International Association of Certified Home Inspectors recommends that ducts be located entirely within conditioned space and tested to ensure air tightness. Air leakage rates at air handlers, even when all ducts are located in conditioned space, can lead to significant reduction in comfort, leading homeowners to adjust the thermostat and significantly increase energy use. See <https://www.nachi.org/inspecting-hvac-cabinet-seams-air-leakage-sealing.htm>.

Bibliography: *Insulation*, U.S. Dep’t of Energy, <https://www.energy.gov/energysaver/weatherize/insulation> (last accessed Dec. 30, 2018). U.S. Dep’t of Energy, *Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes* (Aug. 2015), available at <https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology>.

Cost Impact: The code change proposal will increase the cost of construction

This proposal will require duct testing and meeting a modest duct tightness level in the limited subset of homes that are currently exempt from the test requirement in the IECC. However, we believe the added value in quality control for builders and the likely positive impact on occupant comfort and energy savings will easily outweigh the cost of the test and any remedial efforts to improve duct tightness.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: It important to test the ducts and make certain the air needed to condition the space is delivered appropriately (Vote: 6-5).

Assembly Action:

None

RE112-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

David Bixby, representing Air Conditioning Contractors of America (bixster1953@yahoo.com)

requests Disapprove

Commenter's Reason: ACCA requests disapproval of the proposal in its entirety. The proposal is not cost effective and a duct leakage test will not correct the actual problems that are, in reality, airflow problems. If the ductwork is properly constructed (i.e., put together) according to IRC requirements, as verified by the code official, there should NOT be "excessive leakage" that requires additional sealing or leak testing. When ductwork is inside a building's thermal envelope, any duct leakage from unsealed ductwork enters an already conditioned space within the building thermal envelope. Therefore, no energy loss occurs that is directly related to the sealed and/or unsealed air leakage through the building envelope and not by an unsealed duct in a conditioned space. Although sealing ductwork located inside the building's thermal envelope may provide better comfort for the homeowner, it has no impact on energy efficiency or economic benefits. When discussing building energy efficiency and economic benefits, a homeowner should focus on reducing building leaks, better insulation, windows, and doors, as these are areas where building energy efficiency is lost at the building envelope, not by sealing or leak testing ductwork in a conditioned space. See ACCA Public Comment under Item RE110-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1996

Public Comment 2:

Proponents:

Craig Drumheller, NAHB, representing NAHB (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: This code change is not necessary. There is no need to test a system that is located entirely inside of conditioned space, if there is any leakage it is leaking to conditioned space and dwellings already have to comply with the air sealing requirements. This is an unnecessary code change and would increase the cost of construction by mandating additional testing. Very few multi-family dwelling units have ducts outside conditioned space, this would require testing of nearly every forced air system in the building. A visual inspection on duct systems entirely within conditioned space is sufficient.

Generally, energy will be saved when bringing ducts into conditioned space, this proposal would discourage builders from doing this.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment 3:**Proponents:**

Margo Thompson, representing National Multifamily Housing Council (mthompson@newportventures.net)

requests Disapprove

Commenter's Reason: The proposal, RE-112, removes the exception for testing duct leakage when the ducts and air handler are located entirely within the building's thermal envelope. As a result, it will unnecessarily add cost to multifamily dwelling units without delivering significant energy savings. This is true for multiple reasons.

One rationale for this proposal is that leaky ducts result in poor air delivery and uncomfortable residents who will then adjust the thermostat, thus wasting energy. Multifamily dwellings, in particular, have much smaller floor plans and greatly reduced heating/cooling loads due to adiabatic surfaces compared to most single-family homes. These factors greatly reduce the likelihood that duct leakage will result in an isolated hot or cold spot and trigger thermostat adjustments. While this could happen in a 3500 square foot, two-story single-family detached home, it is much less likely in a 1200 square foot, single floor apartment.

Secondly, the proposal only establishes an actual air leakage *limit* for ducts located in conditioned space if a project is pursuing Prescriptive Compliance with the IECC. If a home is pursuing the Performance Path or the ERI Path for compliance, the proposal makes duct leakage testing Mandatory, but the prescriptive air leakage *limit* of 8 cfm per 100 sf conditioned floor area is something that can be traded off – at least, theoretically. Furthermore, the air leakage test result must still be factored into the energy models which must be developed in order to demonstrate compliance under the Performance or ERI paths. However, the modeling software does not apply any type of penalty for duct leakage that occurs within conditioned space no matter how high it might be. A 1400 sf apartment with all ducts and HVAC equipment entirely within the thermal envelope will show no difference in energy performance or Energy Rating Index (ERI) within the modeling software whether it has 0 cfm total duct leakage or 300 cfm total duct leakage. So, for projects pursuing Performance Path or ERI compliance, RE112 would require a duct leakage test, the result of which will have no bearing on the project's code compliance, the percentage by which it is above or below code, or the Energy Rating Index.

Lastly, field testing requirements like blower door tests or duct blaster tests, when applied to multifamily buildings with dozens or hundreds of very similar units, should include sampling provisions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will result in no change in code text.

The proposal will significantly increase the cost of construction, particularly for multifamily buildings and larger developments of single family homes and townhouses. On average, the cost of a DuctBlaster test is \$250. Assuming an Energy Consultant or HVAC technician might offer a discounted rate for performing multiple tests during a single visit, added cost for a 100-unit apartment complex would still be in the range of \$15,000 - \$20,000. As indicated in the Reason Statement above, there is no energy benefit or energy cost savings to offset the additional testing cost.

RE115-19

IECC: R403.3.3 (IRC N1103.3), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

R403.3 Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.1 Insulation (Prescriptive). Supply and return ducts in attics shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope*.

R403.3.2 Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code, as applicable.

R403.3.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

Revise as follows:

R403.3.3 (IRC N1103.3) Duct testing (Mandatory). ~~Ducts~~ The ductwork in a building or dwelling unit shall be pressure tested to determine for air leakage. The maximum total leakage rate for ducts in any building or dwelling unit under any compliance path shall not exceed 8.0 cfm (226.5 L/min) per 100 square feet (9.29 m²) of conditioned floor area. Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to ~~4.0~~ 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to ~~3.0~~ 4.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to ~~4.0~~ 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Reason: The purpose of this code change proposal is to help ensure long-term energy savings, occupant comfort and promote good building quality by establishing a maximum level of duct leakage permitted as a trade-off backstop for duct tightness. We propose a backstop that would still permit substantial flexibility – double the allowable leakage rate as the prescriptive requirement -- but that would establish a “worst case scenario” for all tested homes in all compliance paths.

There is currently no upper limit on duct leakage in the IECC. In the 2012 IECC, all ducts (except those in conditioned space) were required on a mandatory basis to meet the prescriptive levels. The mandatory nature of the requirement was removed in 2015, allowing duct tightness to be fully traded off for other efficiency measures. We believe some trade-off is acceptable, but that a minimum level of duct tightness is necessary to ensure some reasonable level of duct performance occurs in the home. When ducts are excessively leaky, there is no assurance that conditioned air is provided where it is needed for adequate comfort. The failure to properly distribute conditioned air is likely to result in excess energy usage when the

occupants adjust the thermostat to counter an inadequate distribution of conditioned air. Many of the intended benefits of high-performance homes are negated if occupants are uncomfortable and adjust the thermostat in response.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposal is intended to be cost-neutral, since it does not change the prescriptive requirement, but will ensure that at least some reasonable attention has been paid to duct tightness. Because the new backstop will only apply in homes that are already required to have ducts tested, the only potential cost would come in a situation where a builder has traded away the efficiency of the duct system for an improvement elsewhere in the home at a lower cost such that the home would not even meet the weaker duct tightness level proposed here. However, in such cases, we believe owners and occupants of homes will benefit substantially from having an outer limit on duct leakage.

RE115-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This provides additional clarity and a backstop (Vote: 10-1).

Assembly Action:

None

RE115-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.3.2, R403.3.3 (IRC N1103.3)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.3.2 Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code , as applicable.

R403.3.3 (IRC N1103.3) Duct testing (Mandatory). The ductwork in a building or dwelling unit shall be pressure tested for air leakage. The maximum total leakage rate for ducts in any building or dwelling unit under any compliance path shall not exceed ~~8-0~~ (6) cfm (~~226.5~~ 169.9 L/min) per 100 square feet (9.29 m²) of conditioned floor area when the air handler is installed at the time of testing. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 CFM (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area. Registers shall be taped or otherwise sealed during the test. Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

Commenter's Reason: Public Comment Reason Statement:

The public comment addresses two issues which were not addressed by the five duct leakage proposals that passed during the CAH.

1. The prescriptive duct leakage requirement rightly describes what to do if the air handler is not installed at the time of the duct leakage test. If this is not added to the mandatory section now that a duct leakage target has been introduced, then the flexibility of when a test can occur during the construction cycle is lost which could increase cycle time and cost of construction.
2. This PC lowers the upper duct leakage target in the mandatory section that passed at the CAH from 8 CFM/sqft of conditioned floor area to 6 CFM/sqft. The rationale for this is two-fold.
 1. First, there are energy savings from tighter ducts, as well as health, safety, and durability benefits.
 2. Second, if the ducts are at 6 CFM of total leakage, then that number works 90+% of the time for the duct leakage to outside input in the code compliance software for the simulated performance and ERI paths to demonstrate compliance. Therefore, additional testing is not needed unless more trade-offs are needed or desired and cost savings can be achieved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Per the cost statement of the original proposal (below) these changes are intended to be cost neutral and changing from 8CFM/100sqft to 6 CFM/100sqft should not change that. additional flexibility of when a system can be tested can actually save money by not interfering with cycle time.

Original Cost Statement:

The proposal is intended to be cost neutral, since it does not change the prescriptive requirement, but will ensure that at least some reasonable attention has been paid to duct tightness. Because the new backstop will only apply in homes that are already required to have ducts tested, the only potential cost would come in a situation where a builder has traded away the efficiency of the duct system for an improvement elsewhere in the home at a lower cost such that the home would not even meet the weaker duct tightness level proposed here. However, in such cases, we believe owners and occupants of homes will benefit substantially from having an outer limit on duct leakage.

Public Comment# 1906

RE116-19

IECC: R403.3.3 (IRC N1103.3.3), R403.3.3.1 (IRC N1103.3.3.1) (New), R403.3.3.2 (IRC N1103.3.3.2) (New), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

SECTION R403 (IRC N1103) SYSTEMS

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine both total duct leakage and leakage to the outdoors, air leakage by one of the following methods:

- ~~1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.~~
- ~~2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.~~

Exceptions:

- ~~1. A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.~~
- ~~2. A duct air leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.~~

Add new text as follows:

R403.3.3.1 (IRC N1103.3.3.1) Total duct leakage rough-in test or post construction test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area served, (4cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. If the HVAC duct work system is serving less than 1500 square feet of conditioned floor area, the allowable total duct leakage target shall be 60 cfm regardless of the calculated 4 cfm/100 sqft minimum performance target.
2. A total duct leakage measurement of 80 cfm or less may replace the requirement to test for duct leakage to outside the building's thermal envelope (R403.3.3.2) if compliance can be obtained through the modeling software calculations used to verify compliance with Section R405 or Section R406 for duct leakage to outside penalty or tradeoff.

R403.3.3.2 (IRC N1103.3.3.2) Duct leakage to outside the buildings thermal envelope post construction test. Leakage to outside the building thermal envelope shall be less than or equal to 4 cubic feet minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area served, (4cfm/100sqft), when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, with a blower door and duct leakage testing device. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct leakage to outside test shall not be required where the ducts and air handlers are documented, at a rough stage of construction, to be located entirely within the building's air barrier and thermal envelope. For systems that are not tested, a distribution systems efficiency of (0.96) for leakage to outside shall be permitted to be used when modeling for confirmed compliance with Sections R405 and R406
2. If the HVAC duct work system is serving less than 1500 square feet of conditioned floor area the allowable duct leakage to outside shall be 60 CFM or less.

Revise as follows:

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

- ~~1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.~~

2. ~~Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.~~

Reason:

- Although requiring two duct leakage tests, this proposal actually focuses on total duct leakage. If the total HVAC duct system is tight the built-in exceptions would allow the system not to have to have the second duct leakage to outside test. In addition, if the duct can be verified to be within the Building's Thermal Envelope and continuous air barrier assembly the duct would not have to be tested and could you a default distribution system efficiency. In this way great flexibility has been incorporated into this proposal.
- Currently having both mandatory and prescriptive requirements is confusing. Duct leakage testing is needed and needs to just be required to ensure efficiency, durability, safety, and comfort. Just as it is impossible to visually verify if a home's air barrier system is air tight it is impossible to know if the duct system is tight unless it is tested.
- Both of the current testing paths, prescriptive and mandatory, use the wrong matrix from an energy perspective. In order to ensure the intent of the IECC is maintained regardless of the compliance path, it makes sense to keep the total duct leakage requirement as it deals with the efficiency of the HVAC system from a use perspective. If the master bedroom, for example, is not receiving the quantity of air required by the HVAC design due to leaky ducts, then the thermostat will be adjusted and inefficiencies will be created.
- Adding a Duct leakage to outside (LTO) testing requirement specifically addresses the energy lose component of duct leakage which is also the intent of the IECC. Since duct leakage is associated with two distinct means of inefficiencies, behavior and measured, both tests should be required.
- The 4 cfm/100sqft of floor area target currently penalizes small units, so we have introduced a fix that was first developed by the Energy Star program. Currently the total duct leakage target is based on the amount of conditioned floor area. In this proposal a 'floor' has been added to the duct leakage target for small homes. By 'floor', we mean a lower limit that doesn't decrease as the space gets smaller and smaller.
- Energy Stars target floor is 40 CFM. We have used 80 CFM as it is a more reasonable target for small systems in our current state of installation and sealing expertise. In addition, it is our experience that there is a minimal modeling penalty associated with 80 CFM of duct leakage to outside.

Bibliography: Energy Conservatory

Duct Leakage to Outside Testing Instructions

<http://energyconservatory.com>

Cost Impact: The code change proposal will increase the cost of construction. Currently Total duct leakage testing is required. Duct leakage to outside is also required for IECC code sections R405 simulated performance and R406 ERI pathways. Duct leakage to outside is a tradeable feature and is an input in the modeling software used to demonstrate compliance with the code when using sections R405 and R406. Therefore, the code in essence is currently requiring both tests when these compliance options are used. **Price would increase for those who are using the prescriptive path** but should remain the same for those using the simulated performance path or the ERI path for compliance.

RE116-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is not in alignment with previously approved proposals (Vote: 10-0).

Assembly Action:

None

RE116-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R403, R403.3.3, R403.3.4

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

Replace as follows:

2018 International Energy Conservation Code

SECTION R403 SYSTEMS

R403.3.3 Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.
3. If the HVAC duct system is serving less than 1200 square feet of conditioned floor area the allowable duct leakage to outside shall be 72 CFM or less.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Exception: If the HVAC duct system is serving less than or equal to 1,200 square feet of conditioned floor area, the allowable duct leakage shall be 72 cubic feet per minute or less.

Commenter's Reason: The committee felt that RE116 did not align with other duct leakage proposals that passed prior to hearing RE116 at the CAH. Therefore, this public comment has been drastically narrowed to reintroduced an exception to the quantification of duct leakage when an HVAC system is servicing 1,200 sqft or less. This has support from all proponents of duct leakage proposals that passed at the CAH. The allowance/exception for small dwelling units that are 1,200 sqft or less in size is being reintroduced here because they will have limited ductwork. It becomes irrational to expect to consistently seal the system below 72 CFM or 6 percent as would be required. If you have a 1,000 sqft unit, then the leakage rate at 6 CFM would be 60 CFM. If you had a 500 sqft unit, then the leakage rate would be 30 CFM. This is not practical, and there should be an exception.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal and the exception it proposes for duct leakage testing does not increase cost because it does not change the code requirement to perform a duct leakage test but rather how the results of the test is applied. Therefore, cost remains constant for the testing that is required.

RE117-19

IECC: R403.3.3 (IRC N1103.3.3), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

SECTION R403 (IRC N1103) SYSTEMS

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods ~~and shall not leak more than 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area served, (4cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test.~~

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

- ~~1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.~~
- ~~2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.~~
2. If the HVAC duct system is serving less than or equal to 1,500 square feet of conditioned floor area, the allowable duct leakage shall be 60 cubic feet per minute or less.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

Delete without substitution:

R403.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

- ~~1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.~~
- ~~2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.~~

Reason: Since the 2006 IECC it has been a mandatory requirement to seal ductwork. The language has changed very little and in Section R403.3.2 of the 2018 IECC it now says, "Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable." A separate section is addressing building cavities by stating that, "*Building framing cavities shall not be used as ducts or plenums*" in order to ensure tight, efficient, and well performing HVAC systems. This short historical perspective reminds us that duct leakage has been an important energy conservation issue for quite some time; at least since 2006. However, it was not until the 2009 IECC that mandatory duct leakage testing entered the code. From that point forward the importance of duct leakage on the efficiency and performance of the house has not change, but more and more confusion has been introduced into the code. Currently, this confusion shows itself primarily in the relationship between testing organizations, HVAC contractors and builders, because there is a requirement to test, but there is no testing threshold target for the performance paths by which to hold a system to. Therefore, when using the performance paths, one mistakenly believes that yes, a system must be tested test, but no it does not have to be tight. This inconsistency between section R403.3.2 Sealing and R403.3.3 Duct testing is at the hart of this code change.

The 4 CFM/100 square feet of conditioned floor area leakage threshold is currently only a prescriptive threshold target. This makes some sense as duct leakage is a tradable performance metric in the software tools used to demonstrate compliance using sections R405 and R406. However, it also makes **no** sense as the IECC currently requires a total duct leakage test while sections R405 and R406 require a duct leakage to outside test to assess the performance trade off. To add to the confusion, a field testing organization cannot report to the HVAC contractor and builder if a home has passed the duct leakage testing requirements of the code when using performance compliance options because the software tools must be fully populated with data that is observed at both rough and final stages of construction in order to accurately determine tradeoffs.

This code change proposal simplifies the requirement and enforcement of the requirement. Just as whole house air leakage testing has specific blower door threshold targets, creating one minimum and specific threshold target for duct leakage allows for better and more streamline code adoption and enforcement. From a prescriptive compliance perspective, we know that if the home is equal to or better than the air leakage and duct leakage performance thresholds that it is meeting the minimum efficiency requirements of the code. From a performance perspective we also need to know if the home is meeting the minimum threshold requirements and then additional compliance flexibility is achieved when or if the home performs better. The unintended consequence of introducing a mandatory and prescriptive duct leakage test has only led to mass confusion in the field and a miss interpretation of the requirements.

I believe that the intent of the current 2018 IECC is that the duct leakage testing threshold is the 4% target. However, interpretation abounds. If this proposal is adopted, testing organizations would be able to quickly determine if the home is passing or failing with out argument that tighter systems are not required. Field interpretation from the HVAC contractor and builder side has not been that a specific leakage threshold target must be achieved or that the system must be sealed as Section R403.3.2 Sealing (Mandatory) requires. Instead the field interpretation is often that the system must be tested, but can be extremely leaky. This code change proposal fixes this miss interpretation.

This proposal continues by requiring that the HVAC duct system be tested to a specific minimum target threshold regardless of the location of the duct work. There are two reasons for this change. First, a significant amount of energy savings is achieved when the total leakage of the system is reduced. Remember that the code is currently only testing for total leakage, but only on HVAC systems that have a portion of the duct located outside of the building thermal envelope. When HVAC duct systems are located within the buildings thermal envelop, we are seeing significate total duct leakage that far exceed the 4 CFM/100 square feet of conditioned floor area threshold target, yet the system is in compliance with the code.

BTU's being delivered inside the building's thermal envelop does not equate to a home that is comfortable and efficient unless the correct quantity of BTU's that were designed to be delivered to the specific location occurs. Significant total duct leakage within the thermal envelop by definition ensures that the designed BTU's are not being delivered to their design location therefore causing comfort and efficiency issues. The occupant adjusts the thermostat in an attempt to deliver the required BTU's to the location where they are needed thus casing the system to run more often and less efficiently. The popularity of AeroSeal duct sealing in existing homes is a direct indication of this problem as homeowners seek a solution to leaky inefficient duct work that should have been addressed during construction.

<https://aeroseal.com/>

<https://aeroseal.com/residential/how-aeroseal-works/>

<https://www.youtube.com/watch?v=06DlipDW0GU>

The second reason to require duct leakage testing regardless of where the duct is located is due to cost saving that can be achieved. By just requiring the test to be performed, there will be a move to testing systems at a rough stage of construction to ensure that system testing failures do not impact construction cycle time or the closing of the home. This is the correct stage of construction for conducting the test, as if needed, the system can be economically fixed and retested before drywall has been installed.

Lastly, by holding duct systems to a 4 CFM/100 square feet of conditioned floor area threshold target the likely hood of needing a second test for duct leakage to outside when using R405 and R406 compliance options is low. Total duct leakage numbers in the 4% range can most often be used in software modeling to replace the duct leakage to outside number to demonstrate compliance when duct leakage to outside has not been tested. In other words the HVAC duct system will not leak more to outside than represented by the total duct leakage tested number, so if that number is used to represent duct leakage to outside and the home passes the compliance metrics of sections R405 or R406 then all is good and the home meets the intent of the code.

Cost Impact: The code change proposal will increase the cost of construction

There will be a small cost impact because all duct systems will be required to be tested. However, regardless of where the ducts are located the IECC already requires that the system be sealed in section R403.3.2. It is not possible to visually verified if the duct system is tight just as it is not possible to visually see if a house is air tight, so testing should be required. Energy savings beyond the actual loss of BTU's to the outside will be achieve, but this will require builders and or HVAC contractors to pay testing organizations or third party approved agencies to verify the duct leakage of the system.

RE117-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Do not need any more incentives to move mechanical equipment and ducts out of the attic. It is incumbent on building owners to ensure the system functions as intended (Vote: 6-5).

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION R403, R403.3.3 (IRC N1103.3.3), R403.3.4

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R403 SYSTEMS

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). ~~Ducts~~ The duct work in a building or dwelling unit shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine for air leakage. The maximum total leakage rate for duct in any building or dwelling unit under any compliance path by one of the following methods and shall not exceed leak more than 4 6.0 cubic feet per minute (113.3 169.9 L/min) per 100 square feet (9.29 m²) of conditioned floor area served, (4 6cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test.

Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Alternatively, a duct leakage test to outside conditioned space with a pressure differential of 0.1 w.g. (25 Pa) with reference to the outside across the entire system including the manufacturers' air handler. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required for ducts serving ~~heat or energy recovery ventilators~~ ventilation systems that are not integrated with ducts serving heating or cooling systems.
2. If the HVAC duct system is serving less than or equal to ~~4,500~~ 1,200 square feet of conditioned floor area, the allowable duct leakage shall be ~~60~~ 72 cubic feet per minute or less.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
3. Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 6.0 CFM (169.9 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Exception: If the HVAC duct system is serving less than or equal to 1,200 square feet of conditioned floor area, the allowable duct leakage shall be 72 cubic feet per minute or less.

Commenter's Reason: Public Comment Reason Statement:

The committee was split 6-5 in disapproval of the original RE117 proposal. As 5 CAH proposals dealing with duct leakage did pass many but not all aspects of RE117 have been addressed. Therefore, the public comment and proposal has been structured to incorporate all CAH approved changes to this duct leakage section and address issues which were not addressed by the five duct leakage proposals that passed during the CAH. The CAH Proposals that were approved are, RE112, RE114, RE115, RE118, RE119. Now, one can comprehend the totality of the changes that will occur in this section if this proposal passes. The following has been added or moved.

1. RE119 alternative testing allowance has been moved to Post construction testing as Duct leakage to Outside testing cannot occur at a rough stage of construction.
2. Allowance for testing without the air handler at a rough stage of construction has been added to Section R403.3.3 in order to provide the same level of flexibility that is offered in Section R403.3.4
3. This proposal lowers RE115's upper duct leakage target from 8 CFM/sqft of conditioned floor area to 6 CFM/sqft in the mandatory requirement. The rationale for this is two-fold. First, there are energy savings from tighter ducts within the building envelope, as well as health, safety, and durability benefits. Second, if the ducts are at 6 CFM of total leakage, then that number works 90+% of the time for the duct leakage to outside input in the code compliance software for the simulated performance and ERI paths to demonstrate compliance. Therefore, additional testing is not needed unless more trade-offs are needed or desired.
4. Next, an allowance/exception for small dwelling units that are 1,200 sqft or less in size has been added. A 1,200 sqft dwelling unit will have limited ductwork, and it becomes irrational to expect to consistently seal the system below 72 CFM or 6 percent as would be required. If you have a 1,000 sqft unit, the leakage rate at 6 CFM would be 60 CFM. If you had a 500 sqft unit, it would be 30 CFM. This is not practical, and there should be an exception. There was agreement from the proponents of duct leakage CAH proposals that this exception was worth adding to the code.

Lastly, although there was not total agreement, collaboration with the proponents of the five proposals that passed at the CAH has occurred.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Per the reason statements of the 5 original proposals that passed at the CAH this proposal will be cost neutral or will not increase cost.

There should be a small cost impact because all duct systems will be required to be tested. However, regardless of where the ducts are located the IECC already requires that the system be sealed in section R403.3.2. It is not possible to visually verify if the duct system is tight just as it is not possible to visually see if a house is air tight, so testing should be required. Energy savings beyond the actual loss of BTU's to the outside will be achieved, but this will require builders and or HVAC contractors to pay testing organizations or third party approved agencies to verify the duct leakage of the system. This proposal tries to ensure that the required testing is performed in the most efficient manner to save cost.

Staff Analysis: ANSI/RESNET/ICC 380 is currently referenced in the 2018 IECC. ASTM E1554 has been proposed as a new standard to this section as part of RE114-19. RE114-19 was recommended for approval by the IECC-R code committee. RE114-19 did not receive any public comments and is therefore on the consent agenda.

Public Comment# 1920

RE119-19

IECC: R403.3.3 (IRC N1103.3.4), R403.3.3 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Alternatively, a duct leakage test to outside conditioned space with a pressure differential of 0.1 w.g. (25 Pa) with reference to the outside across the entire system including the manufacturers's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.
2. Postconstruction test: Total leakage or leakage to outside conditioned space shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Reason: Allowing the option for measurement of duct leakage to the outside will give both HVAC installers and homeowners an accurate measurement of duct leaks to the exterior of the building. This is the only true testing method that measures energy loss as the method is measuring the leakage outside the thermal envelope not from inside conditioned space. Duct leakage to the outdoors is an accepted duct testing method in the industry and was allowed under Section 403.2.2 of the 2009 IECC and approved for the 2015 IECC by the committee, but withdrawn by the proponent. Proposed changes provide clarity as to what distribution system efficiency should be applied to the Standard Reference Design and how the ducts should be modeled in the performance path.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not change the cost of construction. It will provide a testing method that measures the true energy loss of ducts.

RE119-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This provides an alternative means to help reduce leakage to the outside (Vote: 6-5).

Assembly Action:

None

RE119-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is a rollback that will reduce energy efficiency and will lead in many cases to reduced occupant comfort and increased energy use. A test for leakage to outdoors only determines if air is being leaked outside the home and, unlike total duct leakage, does not reflect whether conditioned air is actually being delivered to the intended spaces of the home. By definition, total duct leakage may equal leakage to the outdoors in some circumstances, but in many cases it can far exceed leakage to the outdoors. As a result, testing for leakage to the outdoors is a far weaker standard and should not be allowed as an option. The two tests are not interchangeable and should not be treated as such in the code. It should be noted that this proposal (submitted by NAHB) was only narrowly approved by the Committee on a 6-5 vote, which included all 4 builder votes in favor.

Proposals similar to RE119 have been rejected several times in recent code development cycles, most recently RE108-16, which was disapproved by over 95% of Governmental Member Voting Representatives. The efficiency of the delivery system for conditioned air is important, no matter where ducts are located and no matter how much conditioned air ultimately escapes the thermal envelope.

For example, when a substantial amount of conditioned air spills out into the furnace room or otherwise does not reach intended locations in the home, energy modeling software may not recognize this as an efficiency loss, but the home's occupants will respond by tweaking the thermostat to offset the failure to deliver this conditioned air to the desired locations in the home. As we noted in the reason for proposal RE112, in addition to the negative direct impacts on occupants from discomfort, the negative energy use impact of uncomfortable occupants can also be significant. Changing the thermostat setting by just one degree can increase total energy use of the home from 0.5% to 4.7% for heating and 0.4% to 7.8% for cooling, depending on climate zone.

Increased Total Energy Use Resulting from Thermostat Adjustment									
Measure	Weighted	1	2	3	4	5	6	7	8
+1 Degree Heating	4.1%	0.5%	3.0%	4.2%	4.4%	4.7%	4.5%	4.0%	2.9%
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

The only way to ensure that duct systems are delivering conditioned air to the intended locations in the building is to require a total duct leakage test, not a test for leakage to the outdoors. Proposal RE119-19 will create a loophole for poorly-constructed duct systems, and it will lead to increased energy use. It should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

RE121-19

IECC: R403.3.4.1 (IRC N1103.3.4.1) (New), R403.3.4.1.1 (IRC N1103.3.4.1.1) (New), R403.3.4.1.2 (IRC N1103.3.4.1.2) (New)

Proposed Change as Submitted

Proponents: Aaron Gary, representing Self (aaron.gary@texenergy.org)

2018 International Energy Conservation Code

Add new text as follows:

R403.3.4.1 (IRC N1103.3.4.1) Sampling options for R2 multifamily dwelling units. For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Section R403.3.3. Prior to beginning sampling for testing, "Initial Testing" is required for each multifamily property. "Initial Testing" shall consist of the 3rd party testing contractor performing the required tests on at least three consecutive dwelling units. Test results from the "Initial Testing" must satisfy minimum code requirements before sampling is permitted. Dwelling units selected for the "Initial Testing" must be within the same building. Dwelling units selected for "Initial Testing" shall not be included in a "sample group" or counted toward the minimum 15% of dwelling units tested. The building official shall randomly select the three dwelling units for "Initial Testing." The building official may delegate the random selection to the designated 3rd party testing contractor.

R403.3.4.1.1 (IRC N1103.3.4.1.1) Sample group Identification and Sampling The builder shall identify a "sample group" which may be a building, floor, fire area or portion thereof. All of the dwelling units within the "sample group" must be at the same stage of construction and must be ready for testing. The building official shall randomly select at least 15% of dwelling units from each "sample group" for testing. The building official may delegate the random selection to the designated 3rd party testing contractor.

If each tested dwelling unit within a "sample group" meets the minimum code requirements, then all dwelling units in the "sample group" are considered to meet the minimum code requirements.

Before a building may be deemed compliant with the testing as required, each "sample group" must be deemed compliant with the minimum code requirements. The sum total of all of the tested dwelling units across all "sample groups" shall not be less than a minimum of 15% of the dwelling units in a building.

R403.3.4.1.2 (IRC N1103.3.4.1.2) Failure to Meet Code Requirement(s). If any dwelling units within the identified "sample group" fail to meet a code requirement as determined by testing, the builder will be directed to correct the cause(s) of failure, and 30% of the remaining dwelling units in the "sample group" will be randomly selected for testing by the building official, or third-party testing contractor, regarding the specific cause(s) of failure.

If any failures occur in the additional dwelling units, all remaining dwelling units in the sample group must be individually tested for code compliance.

A multifamily property with three failures within a 90-day period is no longer eligible to use the sampling protocol in that community or project until successfully repeating "Initial Testing." Sampling may be reinstated after at least three consecutive dwelling units are individually verified to meet all code requirements.

A Certificate of Occupancy may not may be issued for any building until testing has been performed and deemed to satisfy the minimum code requirements on the dwelling unit(s) identified for testing.

Reason: For many multifamily (R2 classifications) projects, it is very costly and time consuming to test each dwelling unit for projects where there may be dozens of dwelling units in each building. Considering that the same tradesman generally constructs a building, it is reasonable to deem that construction practices are consistent and that if a reasonable sampling of units tested pass then all units would pass. These amendments (originally drafted by the North Texas Council of Governments Energy and Green Advisory Board) or are very similar ordinances, have been accepted across Texas by the EHJs including the City of Dallas, the City of Austin, and the City of San Antonio.

Cost Impact: The code change proposal will decrease the cost of construction

This code change proposal will streamline the cost and time required to conduct on-site verification of Code which will result in lower testing costs and faster construction timelines

RE121-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The language is not appropriate for the code, and 15% is too low of sample size (Vote: 6-5).

Assembly Action:

None

RE121-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.3.5 (New)

Proponents:

Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

R403.3.5 Sampling for multifamily dwelling and sleeping units. Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the duct air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit conditioned area. Units shall be tested separately as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit conditioned area. For each tested unit that exceeds the maximum duct air leakage rate, 2 additional units shall be tested, including a mixture of testing unit types and locations.

Commenter's Reason: The Committee reason for Disapproval was that, " The language is not appropriate for the code, and the 15% is too low of (a) sample size." The revised language I am proposing addresses both of these reasons while maintaining the intent of the original Code Change Proposal. The revised language, which is substantially similar to language approved by the Commercial Energy Committee for a testing requirement for multifamily dwelling units, increases the minimum sampling rate to 20%.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal will neither increase nor decrease the cost of construction. It will streamline the time required to conduct on-site testing which will translate to better compliance and faster construction timelines.

Public Comment# 2078

RE126-19

IECC: R202 (IRC N1101.6), R403.5.1 [IRC N1103.5.1] (New), TABLE R403.5.1 [IRC N1103.5.1] (New)

Proposed Change as Submitted

Proponents: Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new text as follows:

R403.5.1 (IRC N1103.5.1) Water heating equipment. Service water heating equipment shall be one or more of the following types:

1. Storage gas water heater with a uniform energy factor (UEF) that meets the requirements of Table R403.5.1.
2. Storage electric water heater utilizing not less than 1.0 kW of on-site renewable energy.
3. Heat pump water heater with a UEF not less than of 2.0.
4. Tankless water heater.
5. Grid-enabled water heater.
6. Solar water heating system having a solar fraction of not less than 0.5.

**TABLE R403.5.1 (IRC N1103.5.1)
MINIMUM UNIFORM ENERGY FACTOR (UEF) FOR STORAGE GAS WATER HEATERS**

FIRST HOUR RATING^a	MINIMUM UEF
Very Small	0.24
Low	0.50
Medium	0.64
High	0.68

a. The first hour rating of a water heater is determined by the federal test procedure. It is listed on the Energy Guide label affixed to the water heater.

SECTION R202 (N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

GRID-ENABLED WATER HEATER. An electric water heater that includes controls that enable activation for use as part of an electric thermal storage or demand response program.

SOLAR FRACTION. The fraction of total annual water heating energy met by a solar water heater.

Reason: This proposal improves the energy efficiency of the prescriptive path of the code while continuing to offer builders the same level of flexibility they already enjoy. Builders may still install any type of water heater that works for the home and location, including storage gas or electric water heaters. While it is true that not every home may be able to utilize every option listed, there is an option that is appropriate for any home. This proposal also modifies only the prescriptive path, which leaves builders the flexibility of the performance and ERI paths. This proposal is structured so that it does not trigger provisions of the National Appliance Energy Conservation Act (NAECA). See attached for a legal memorandum.

Residential envelopes have been getting tighter and better over the last few years. As a result, domestic water heating energy is emerging as a significant end-use from the efficiency stand-point. There are multiple ways of improving the efficiency of generating hot water in homes.

The US Department of Energy’s analysis for the standard that took effect in 2015 found that high-efficiency gas storage water heaters cost less upfront to install in new construction than standard efficiency models, due to lower venting costs of the high-efficiency equipment[1]. Furthermore, this efficiency level is cost-effective for customers compared to a standard model, saving more than \$200 in energy costs. This means that customers will save money on their bills by installing a more efficient gas storage water heater *and* will pay less to purchase the efficient model than the less-efficient model. Gas furnaces that meet the Uniform Energy Factors specified in this proposal are widely available. Uniform Energy Factors are specified, per the DOE federal test procedure, based on the equipment’s First Hour Rating, which is clearly labeled on the yellow Energy Guide label affixed to each

Storage electric water heaters may be installed, when coupled with solar energy. The purpose of this requirement is to offset the electricity used to heat the water, saving money for the consumer. In addition, solar energy is a strong selling point for a new home.

DOE analysis found that heat pump water heaters that replace electric storage water heaters are wildly cost-effective in all climate zones, in spite of their higher equipment costs. Homeowners will save more than \$500 in energy costs compared to even an efficient electric storage water heater.

Tankless water heaters were cost-effective in the warmer climate zones, but were not as cost-effective in the colder climate zones.

As part of DOE’s appliance and equipment standards initiative, stakeholders expressed the importance of electric resistance water heaters to electric thermal storage (ETS) programs, so those grid-enabled water heaters are also incorporated into this proposal. Utilities use ETS programs, sometimes also known as load shifting or demand response programs, to manage peak demand load by limiting the times when certain appliances are operated. In certain water-heater based ETS programs, a utility typically controls a water heater remotely to allow operation only when electricity demand is during off-peak hours. During that off-peak operation, the electricity consumed is stored by the water heater as thermal energy for use during peak hours when the utility prevents the water heater from using electricity.

A solar water heating system can be designed in a variety of different ways. They can directly heat the water using the sun, can indirectly transfer heat from the sun to water in a storage tank, or can use pumps and valves to move water from collectors to a storage tank. They can have either gas or electric backup heating capabilities. This proposal requires at least half of the total energy delivered to the water heater to be generated through solar energy.

[1] U.S. Department of Energy, Energy Efficiency and Renewable Energy Office. Water Heater Technical Support Document Analytical Tools. Retrieved on January 11, 2019 from <https://www.regulations.gov/document?D=EERE-2006-STD-0129-0046>.

LEGAL MEMORANDUM CONCERNING NRDC'S PROPOSED R403.5.1 AND THE
NATIONAL APPLIANCE ENERGY CONSERVATION ACT

Introduction

The Natural Resources Defense Council (NRDC) proposes the addition of R403.5.1 to Chapter 4 of the 2018 International Efficiency Conservation Code (IECC).¹ The proposed addition prescribes six types of water heaters which may be installed by builders in order to comply with the prescriptive compliance pathway of IECC Chapter 4. Some commenters on similar past proposals expressed concern that such a provision would be preempted by the National Appliance Energy Conservation Act, which amended the Energy Policy Conservation Act and set up the energy efficiency standards program for appliances, including water heaters. This is not the case. The proposed code addition comports with the federal statutory provision for building codes because it does not require installation of water heaters that exceed the current federal minimum level.

Legal Analysis

As explained in greater detail below, the issue is whether these proposed additions would effectively require builders to use products that are more efficient than required by federal efficiency standards and thus would trigger preemption. Because they do not there is no preemption concern here.

The National Appliance Energy Conservation Act provides that state building codes may include provisions concerning the efficiency of appliances covered by federal efficiency standards if they meet seven specified requirements.² Commenters in the past expressed concern that the provision would not meet two of these requirements: Sections 6297(f)(3)(B) and 6297(f)(3)(E). The basic requirement of these two provisions is that the building code not require use of an appliance more efficient than the level set by the Department of Energy under the Act.

The first of these focuses on the code as a whole. It states, in relevant part, that the code may not "require that the covered product have an energy efficiency exceeding the applicable energy conservation standard" The second provision concerns building codes that offer optional combinations of items.³ Our proposed changes easily satisfy this provision because, as discussed below,

¹ This memorandum is submitted as an attachment to NRDC's July 21, 2016 proposed amendment.

² 42 U.S.C. § 6297(f)(3).

³ It is not clear whether the optional "combinations of items" applies to the prescriptive pathway at all. 42 U.S.C § 6297(f)(3)(E). Assuming that it does, we believe the relevant "combination" would be the combination of each of the different water heater options and the rest of the prescriptive options. The proposed standard avoids preemption because it includes multiple optional combinations that include minimum efficiency water heaters and only two that require higher efficiency appliances.

four of the six options do not involve products that exceed existing federal standards. (A fifth option may not require a standard-exceeding product depending on the first hour rating of the water heater.)

The presence of some more efficient options does not trigger preemption. In interpreting these provisions, the Ninth Circuit Court of Appeals has recognized that “a builder is not ‘required’ to select a [more efficient] option . . . simply because there is an economic incentive to do so.”⁴

The proposed amendment would be not preempted because it allows installation in new residential buildings of minimum-efficiency water heaters. The statutory preemption test focuses on the “covered product,” which is defined in this case as water heaters.⁵ Thus, a building code is not preempted so long as it does not require installation of a covered product – in this case a water heater – that is above the minimum efficiency level. The proposed amendment plainly does not do so for several reasons. First, the performance path (Section 405) and the Energy Rating Index path (Section 406) focus on overall energy use and include no water heater requirements at all.

Second, even just considering the prescriptive pathway, the proposed amendment still does not require use of a water heater that exceeds minimum federal standards. The proposed amendment allows builders to select any of the six prescribed types of water heaters, at least two of which clearly do not exceed the federal requirements: tankless water heaters (R403.5.1.4) and grid-enabled water heaters (R403.5.1.5). For tankless water heaters, the proposed code amendment contains no minimum efficiency standard and thus the federal standards would apply.⁶ For grid-enabled water heaters, the proposed code complies with the federal provision.⁷ As such, builders can comply with the standard by using water heaters that meet, but do not exceed, federal efficiency standards. Indeed, even if these minimum efficiency options were not available, the prescriptive path would still not “require” use of higher efficiency water heaters since any type of water heater can be used under the prescriptive approach if combined with other options such as a solar water heater.⁸

The proposed amendment is also similar to existing building code provisions. The prescriptive compliance path in California’s 2016 building code, for instance, requires installation of either gas/propane instantaneous water heaters or gas/propane storage type water heaters in new residential dwellings.⁹ California’s prescriptive compliance path allows use of certain minimum efficiency water heaters but does not allow use of every type of minimum efficiency water heater. Like the proposed

⁴ *Building Industry Ass’n of Wash. v. Wash. State Bldg. Code Council*, 683 F.3d 1144, 1151 (9th Cir. 2012).

⁵ 42 U.S.C. § 6292(a)(4).

⁶ Energy Conservation Program for Consumer Products: Definitions and Standards for Grid-Enabled Water Heaters, Final Rule, 80 Fed. Reg. 48004-01 (August 11, 2015).

⁷ *Id.*

⁸ See *Building Industry Ass’n of Wash.*, 683 F.3d at 1151.

⁹ 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Section 150.1(c)(8)(A), available at <http://www.energy.ca.gov/title24/2016standards/index.html>.

code, the California code allows builders to choose an alternate compliance path, which allows use of any water heater.¹⁰

Conclusion

The core requirement for a building code to avoid preemption is that it not require above-minimum efficiency appliances. This requirement is met by the NRDC proposal because the proposal offers multiple ways that minimum efficiency water heaters can be used under both the prescriptive and performance pathways.

¹⁰ See International Energy Conservation Code, R401.2, available at <http://codes.iccsafe.org/app/book/toc/2015/I-Codes/2015%20IECC%20HTML/index.html>.

Bibliography: U.S. Department of Energy, Energy Efficiency and Renewable Energy Office. Water Heater Technical Support Document Analytical Tools. Retrieved on January 11, 2019 from <https://www.regulations.gov/document?D=EERE-2006-STD-0129-0046>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal provides a list of options for a builder to choose from. In some instances the builder may choose an option which increases construction costs, but there are many options that will not increase costs. For instance, the US Department of Energy's analysis for the water heater standard that took effect in 2015 found that high-efficiency gas storage water heaters cost less upfront to install in new construction than

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal limits potential technological development. Good first step, please bring back, being cautious of staying within federal minimums (Vote: 11-0).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.5.1 (IRC N1103.5.1) (New), TABLE R403.5.1 (IRC N1103.5.1) (New), SECTION R202 (N1101.6), 202 (New)

Proponents:

Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.5.1 (IRC N1103.5.1) Water heating equipment. Service water heating equipment shall be one or more of the following types:

1. ~~Storage gas water heater with a uniform energy factor (UEF) that meets the requirements of Table R403.5.1.~~
2. ~~Storage electric water heater, utilizing and not less than 1.0 kW of on-site renewable energy.~~
3. Heat pump water heater.
4. Tankless water heater.
5. *Grid-enabled water heater.*
6. ~~Solar water heating system having a *solar fraction* of not less than 0.5.~~

Exception: Installation of one or more of the following types:

1. Replacement water heating equipment
2. Storage gas water heater with a uniform energy factor (UEF) that meets the requirements of Table R403.5.1.
3. Storage electric water heater, utilizing and not less than 1.0 kW of on-site renewable energy.
4. Solar water heating system having a *solar fraction* of not less than 0.5.
5. Any other type of water heating system not explicitly listed in Section R403.5.1 (IRC N1103.5.1), and not less than 1.0 kW of on-site renewable energy.

**TABLE R403.5.1 (IRC N1103.5.1)
MINIMUM UNIFORM ENERGY FACTOR (UEF) FOR STORAGE GAS WATER HEATERS**

FIRST HOUR RATING ^a	MINIMUM UEF
Very Small	0.24
Low	0.50
Medium	0.64
High	0.68

a. The first hour rating of a water heater is determined by the federal test procedure. It is listed on the Energy Guide label affixed to the water heater.

SECTION R202 (N1101.6) GENERAL DEFINITIONS

GRID-ENABLED WATER HEATER. An electric water heater that includes controls that enable activation for use as part of an electric thermal storage or demand response program.

SOLAR FRACTION. The fraction of total annual water heating energy met by a solar water heater.

Commenter's Reason:

This proposal should be approved as modified. It has been modified to provide additional clarity and flexibility, while maintaining the integrity of the original proposal.

The proposal requires builders to install either a tankless water heater, a grid-enabled water heater, or a heat pump water heater, with an exception for if a builder installs a water heating system from a list of additional options. The additional options include storage gas water heaters (some of which must be more efficient than the federal minimum standard), electric resistance water heaters (if the home also has at least 1.0 kW of on-site renewable energy generation) and solar water heating systems, among others. The proposal is structured in this way to respond to the Committee's comments about being clear which water heating efficiency levels are set at federal minimum standards, and which are more efficient or require installation of additional components.

Tankless water heaters, grid-enabled water heaters, and heat pump water heaters clearly do not exceed the federal requirements. But even if these options were not available for a home, or did not make economic sense, many of the options in the exception can utilize water heater heating equipment that meets the federal standard if combined with other options. For example, a builder may install any electric resistance water heater, provided the home also has at least 1 kW of on-site renewable energy. Similarly, any type of water heater may be paired with a solar water heating system.

Other states and jurisdictions are already incorporating water heaters into their building codes. Washington state recently passed legislation that would require all electric water heaters to have a modular demand response communications port compliant with certain standards that make it grid-enabled. The Washington requirement takes effect January 1, 2021, and applies to all electric storage water heaters offered for sale, for use in both new and existing buildings. California's Title 24 building code requires installation of either gas/propane instantaneous water heaters or gas/propane storage type water heaters in new residential dwellings. In the case of California, the prescriptive compliance path allows use of certain minimum efficiency water heaters, but does not allow use of every type of minimum efficiency water heater. As such, the proposal at hand is significantly more permissible and flexible than what is currently in place in California.

This proposal continues to be relevant only to the prescriptive path of the code. Builders may use any type of water heater they choose if they follow the performance or ERI path of the code.

Bibliography: State of Washington, House Bill Report 2SHB 1444, As Passed Legislature: <http://lawfilesexternal.wa.gov/biennium/2019-20/Pdf/Bill%20Reports/House/1444-S2%20HBR%20PL%2019.pdf>

California Energy Commission, Building Energy Efficiency Standards, Title 24, Section 150 (Mandatory Features and Devices): <http://lawfilesexternal.wa.gov/biennium/2019-20/Pdf/Bill%20Reports/House/1444-S2%20HBR%20PL%2019.pdf>

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The requirements of the code change will increase the cost of construction, as tankless water heaters, grid-enabled, and heat pump water heaters tend to cost more than some "conventional" tank water heating models. However, if a builder chooses to comply via the options available in the exception, there may be little or no increased cost. As mentioned in the reason statement, many of these options allow for installation of minimum efficiency equipment when paired with other options like on site renewable energy production.

RE130-19

IECC: R403.6.2 (IRC N1103.6.2) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robb@nrglogic.com)

2018 International Energy Conservation Code

Add new text as follows:

R403.6.2 (IRC N1103.6.2) Testing. Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts. Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

Exception: Kitchen range hoods that are ducted to the outside with 6" or larger duct and one or less 90° elbow or equivalent in the duct run are exempt from this requirement to test air flow.

Reason: As we continue to be guided by sound building science to build tight homes as required by the IECC to achieve better predictability and control of air flow, thermal flow, and moisture flow spot/local and whole house ventilation becomes an even more crucial aspect of ensuring that the full intent of the IECC is met. This includes durability, safety, healthy, flexibility in how we build, as well as, efficiency of the structure. If we do not more actively ensure that the systems in our homes are not only there, but are also performing as intended we have missed the mark with regards to the intent of the code and creating dwellings that are durable, safe, healthy, and efficient. The testing experience gained through the verification of the EnergyStar program has clearly demonstrated that ventilation fans are installed but are not performing as required by the code. Fan rated flow does not equate to the flow that is actually produced once a fan has been installed. The quality of the installation of the duct from the fan to the termination of the duct to the outside, as well as, the quality of the termination device ultimately governs the amount of air that any fan can push. Simple cost-effective testing is available to ensure that the systems in our homes are not only there but have been installed in such a way that they work as intended by the code.

Allison Bailes Energy Vanguard blog post titled, "The 2 Main Problems With Kitchen Ventilation" which can be found here <https://www.energyvanguard.com/blog/2-main-problems-kitchen-ventilation> Offers additional rational regarding the consequences of poor ventilation from research conducted by Brett Singer and others at Lawrence Berkeley Laboratory. If you are interested there are additional links at the end of his post to related articles that further discuss this issue. I offer this background information to demonstrate that beyond the physical failure of measured fan flow to meet the requirements of code, that there is an extensive study being produced on the effects of improper ventilation. Requiring testing of spot/local and whole house ventilation system will move the building industry into compliance with the code by offering direct feedback on the fan choice and the installation. In the most flexible way possible this feedback will guide fan choice and installation techniques that will become compliant with the code.

Cost Impact: The code change proposal will increase the cost of construction

The cost implications of this code change are small. Qualified testing personnel are already available and at the building performing blower door and duct leakage tests. Adding simple flow measurements of ventilation systems at the same time a blower door test occurs, for example, is not only practical but cost-effective. An increase in cost of \$25-\$50 is well worth the reduction in builder risk, occupant health, and efficiency issues that are associated with poor implementation of code required moisture and pollutant management.

RE130-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: It makes sense to test these pieces of equipment and there is a standard we can rely on (Vote: 6-5).

Assembly Action:

None

RE130-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.6.2 (IRC N1103.6.2) (New)

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.6.2 (IRC N1103.6.2) Testing. Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts. Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

Exception-Exceptions:

1. Kitchen range hoods that are ducted to the outside with 6" or larger duct and one or less 90° elbow or equivalent in the duct run are exempt from this requirement to test air flow.
2. Mechanical ventilation systems verified by an approved, independent laboratory to provide the following are exempt from any requirement for third party airflow testing: programmable and self-modulating flow rate, ability to achieve the programmed flow rate within 10% or 5 CFM, and a user interface that communicates when the flow rate is achieved.

Commenter's Reason: Verification of ventilation system flow rate is critical to ensuring systems meet minimum code requirements. This modification to the original proposal is in keeping with the objective of verifying flow rate, but it adds another option for doing so by encouraging innovation of products that are laboratory-verified to modulate flow to the user's selected flow rate and communicate via a user-interface whether or not the user's selected flow is achieved. To encourage the development and specification of such laboratory-verified self-modulating systems, this proposal waives any requirement for third-party field verification of the flow rate.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The original proposal will increase the cost of construction by adding testing requirements. The PC to the proposal will help to reduce costs by providing additional compliance options.

Public Comment# 2122

Public Comment 2:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: The proposed change which proposed to require testing of ventilation flow rates has no meaning and should be disapproved. The proposal states that "Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6." Section R403.6 references Table R403.6.1. Table R403.6.1 is for Whole-House Mechanical Ventilation System Fan Efficacy and has flow rates for bathroom/utility room fans to determine the minimum efficacy of the fan. The flow rates for other fans listed have no minimum or maximum flow rate. Testing of the fans is to determine minimum efficacy (CFM/WATT).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1195

RE132-19 Part I

IECC: R403.6 (IRC N1103.6)

Proposed Change as Submitted

Proponents: Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). ~~The building~~ Buildings and dwelling units shall be provided with mechanical ventilation that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Reason: Changes to R303.4

Section N1102.4 establishes MANDATORY requirements for air sealing of the building envelope, including mandatory requirements to follow the air barrier and insulation installation criteria in Table N1102.4.1.1 and the mandatory blower door testing and verification requirements in Section N1102.4.1.2. Further, all dwelling units complying with Section N1102.4 require a blower door test with results that achieve 5 ACH50 or less. Thus, all dwelling units complying with Section N1102.4 already require whole-house mechanical ventilation. This change simplifies Section R303.4 and future-proofs the intent of the section by ensuring that tight dwelling units will continue to be provided with whole-house mechanical ventilation, regardless of the metric used to verify that the dwelling units are tight (e.g. there are several proposals being heard in Group B that would move from the metric of ACH50 to a metric of cfm50/ft2).

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. ~~< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >~~ Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Changes to Section 403.6

In keeping with IRC Section R303.4 and IMC Section 401.2, the heading of section 403.6 requires "mechanical" ventilation for buildings complying with the IECC-Residential. To clarify that this is the intent of this section and is coordinated with the IRC and IMC (which contain mechanical ventilation requirements for buildings and dwelling units), the words "mechanical" and "dwelling units" are proposed for inclusion within the text of R403.6.

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. ~~< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >~~ Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal is a clarification of current requirements of the IRC, IMC, and IECC and does not increase or decrease the cost of construction.

RE132-19 Part I

Public Hearing Results

Committee Action:

As Modified

Committee Modification: R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). Buildings and dwelling units complying with Section 402.4.1 shall be provided with mechanical ventilation that complies with the requirements of Section M1505 of the International Residential Code or

International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Committee Reason: With modification the proposal provides necessary guidance for builders and inspectors in install ventilation correction, the modification adds the two sections needed for a reasonable pointer (Vote: 8-3).

Assembly Action: **None**

RE132-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: RE132-19 Part I and RE132-19 Part II are joint proposed code changes and they should both be disapproved. Disapproval of one and approval of the other would have no meaning and create confusion in the code. Contrary to the Reason Statement and Cost Impact which states "the changes are a "clarification" of current requirements, they greatly expand the requirements for mechanical ventilation to require all R occupancies to be mechanically ventilated. The proposals do not include any justification to support the change and the statement that the proposed changes will not increase or decrease the cost of construction is in error. Clearly requiring mechanical ventilation when it is not currently required will have a cost increase.

The proposed change to RE132-19 Part 1 to Section R403.6 adds the word "mechanical" before ventilation which in effect changes the current code requirements and will require mechanical ventilation of all R occupancies. This conflicts with the reference to the International Residential Code or International Mechanical Code. The IMC currently allows natural ventilation or mechanical ventilation. The proposed change is not necessary as the requirements for ventilation are already covered in the current codes.

Changes of this type should be proposed to the IMC which clearly in the current codes has the provisions for what type of ventilation is required.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1217

RE132-19 Part II

IRC@: R303.4

Proposed Change as Submitted

Proponents: Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Residential Code

Revise as follows:

R303.4 Mechanical ventilation. ~~Where the air infiltration rate of a dwelling unit is 5 air changes per hour or less where tested with a blower door at a pressure of 0.2 inch w.c. (50 Pa) in accordance with Section N1102.4.1.2, the dwelling unit~~ Dwelling units complying with Section N1102.4.1 shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

Reason: Changes to R303.4

Section N1102.4 establishes MANDATORY requirements for air sealing of the building envelope, including mandatory requirements to follow the air barrier and insulation installation criteria in Table N1102.4.1.1 and the mandatory blower door testing and verification requirements in Section N1102.4.1.2. Further, all dwelling units complying with Section N1102.4 require a blower door test with results that achieve 5 ACH50 or less. Thus, all dwelling units complying with Section N1102.4 already require whole-house mechanical ventilation. This change simplifies Section R303.4 and future-proofs the intent of the section by ensuring that tight dwelling units will continue to be provided with whole-house mechanical ventilation, regardless of the metric used to verify that the dwelling units are tight (e.g. there are several proposals being heard in Group B that would move from the metric of ACH50 to a metric of cfm50/ft2).

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. ~~< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >~~ Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Changes to Section 403.6

In keeping with IRC Section R303.4 and IMC Section 401.2, the heading of section 403.6 requires "mechanical" ventilation for buildings complying with the IECC-Residential. To clarify that this is the intent of this section and is coordinated with the IRC and IMC (which contain mechanical ventilation requirements for buildings and dwelling units), the words "mechanical" and "dwelling units" are proposed for inclusion within the text of R403.6.

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. ~~< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >~~ Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal is a clarification of current requirements of the IRC, IMC, and IECC and does not increase or decrease the cost of construction.

RE132-19 Part II

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R303.4 Mechanical ventilation. Buildings and Dwelling units complying with Section N1102.4.1 shall be provided with ~~whole-house~~ mechanical ventilation in accordance with Section M1505.4 of this code, or with other approved means of ventilation.

Committee Reason: This provides consistency between IRC and IECC pointing to the Mechanical Code, the modification adds the two sections needed for a reasonable pointer with the retention of the word "mechanical" (Vote: 8-1).

Assembly Action:

None

RE132-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: RE132-19 Part I and RE132-19 Part II are joint proposed code changes and they should both be disapproved. Disapproval of one and approval of the other would have no meaning and create confusion in the code. Contrary to the Reason Statement and Cost Impact which states "the changes are a "clarification" of current requirements, they greatly expand the requirements for mechanical ventilation to require all R occupancies to be mechanically ventilated. The proposals do not include any justification to support the change and the statement that the proposed changes will not increase or decrease the cost of construction is in error. Clearly requiring mechanical ventilation when it is not currently required will have a cost increase.

The proposed change to RE132-19 Part 1 to Section R403.6 adds the word "mechanical" before ventilation which in effect changes the current code requirements and will require mechanical ventilation of all R occupancies. This conflicts with the reference to the International Residential Code or International Mechanical Code. The IMC currently allows natural ventilation or mechanical ventilation. The proposed change is not necessary as the requirements for ventilation are already covered in the current codes.

Changes of this type should be proposed to the IMC which clearly in the current codes has the provisions for what type of ventilation is required.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1218

RE136-19

IECC; TABLE R403.6.1 (IRC N1103.6.1)

Proposed Change as Submitted

Proponents: Mike Moore, Newport, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY^a**

FAN LOCATION	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)	AIR FLOW RATE MAXIMUM(CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

a. When tested in accordance with HVI Standard 916. Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure ≥ 0.2 in. w.c. Fan efficacy for range hoods, bathroom, and utility room fans shall be taken at a static pressure ≥ 0.1 in. w.c.

Reason: Fan efficacy varies as a function of static pressure, so it is necessary to identify the minimum static pressure required for determining the rating. These pressures are aligned with industry practice and ENERGY STAR's requirements for reporting fan efficacy.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal clarifies a current requirement of the code. There is no expected change in construction costs.

RE136-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proponent requested disapproval because the standard referenced in his modification is not yet available (Vote 11-0).

Assembly Action:

None

RE136-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.6.1, TABLE R403.6.1 (IRC N1103.6.1)

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.6.1 Whole-house mechanical ventilation system fan efficacy. Fans used to provide whole-house mechanical ventilation shall meet the efficacy requirements of Table R403.6.1 at one or more rating points. Fans shall be tested in accordance with HVI Standard 916 and listed. The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV, ERC, balanced, and in-line fans shall be determined at a static pressure of not less than 0.2 inch w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be determined at a static pressure of not less than 0.1 inch w.c.

**TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY^a**

FAN LOCATION	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)	AIR FLOW RATE MAXIMUM(CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

- a. ~~When tested in accordance with HVI Standard 916 Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure \geq 0.2 in. w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be taken at a static pressure \geq 0.1 in. w.c.~~

Commenter's Reason: Fan efficacy varies as a function of static pressure, so it is necessary to identify the minimum static pressure required for determining the rating. The static pressures proposed are aligned with industry practice and ENERGY STAR's requirements for reporting fan efficacy. This comment provides needed clarification to the original proposal and improves enforceability. The addition of "and listed" aligns this section with the requirements of M1505.3 (as modified by Group A's RM30, which was approved as submitted) for consistency.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal provides clarification to a current requirement and therefore does not increase or decrease the cost of construction.

Public Comment# 1916

RE139-19

IECC: R403.6.1 (IRC N1103.6.1) (New)

Proposed Change as Submitted

Proponents: Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building* shall be provided with ventilation that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Add new text as follows:

R403.6.1 (IRC N1103.6.1) Heat or Energy Recovery Ventilation (Prescriptive). Dwelling units shall be provided with a heat recovery or energy recovery ventilation system in climate zones 7 and 8. The system shall be balanced with a minimum sensible heat recovery efficiency of 65% at 32°F (0°C) at a flow greater than or equal to the design airflow.

Reason: A recent study conducted by Pacific Northwest National Laboratory showed HRVs and ERVs to be cost effective in climate zones 7 and 8, with annual energy savings from \$138 to \$233 on an initial investment of ~\$1500 installed (corresponding to a first cost premium of ~\$840 versus an exhaust only system and one entry-level bath fan; yielding simple paybacks of 4-6 years). This proposal is aligned with recent changes across most of Canada to require heat recovery ventilation for dwelling units. This proposal would require heat or energy recovery ventilators only for those dwelling units following the prescriptive path in the coldest climate zones, which represents a conservative improvement to the code.

Bibliography: Taylor, T. 2018. Residential Heat Recovery Ventilation Technical Brief. Pacific Northwest National Laboratory. PNNL-28354. <https://www.osti.gov/servlets/purl/1488935>.

Cost Impact: The code change proposal will increase the cost of construction

The first cost of construction (including costs for appliance, equipment, and installation) is expected to increase by ~\$830 compared to an exhaust-only system. Based on PNNL's projected energy savings, this will be recovered quickly, within 4-6 years. Assuming the \$830 is financed in a traditional, 30-year mortgage at 4%, the annual energy savings of \$138-\$233 would generate \$90 - \$185 per year in cash flow for the home owner.

RE139-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This is a cost effective strategy that makes a lot of sense in climate zones 7 and 8 (Vote: 11-0).

Assembly Action:

None

RE139-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests Disapprove

Commenter's Reason: This proposal appears to preempt the International Mechanical Code by requiring one mechanical ventilation technology over another. The IECC should set reasonable guidelines for deployment of each type of ventilation equipment so that the mechanical designer can select the equipment that best suits the needs of each specific project not favor a specific type of equipment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval of this proposal will not increase or decrease the cost of construction as the net result would be no change to the code.

Public Comment# 2093

RE145-19

IECC: R202, R404.1, R404.2 (New)

Proposed Change as Submitted

Proponents: Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new definition as follows:

DIMMER. (IRC N1101.6). A control device that is capable of continuously varying the light output and energy use of light sources.

Revise as follows:

HIGH-EFFICACY LAMPS. (IRC N1101.6). Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps Any lamps with an efficacy of not less than the following: 70 lumens per watt.

- ~~1. 1-60 lumens per watt for lamps over 40 watts.~~
- ~~2. 2-50 lumens per watt for lamps over 15 watts to 40 watts.~~
- ~~3. 3-40 lumens per watt for lamps 15 watts or less.~~

Add new definition as follows:

OCCUPANT SENSOR CONTROL. (IRC N1101.6). An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment or appliances to be regulated accordingly.

Revise as follows:

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). ~~Not less than 90 percent of the~~ All permanently installed lighting fixtures shall contain only high-efficacy lamps.

Add new text as follows:

R404.2 (IRC N1104.2) Lighting Controls (Mandatory). Permanently installed lighting fixtures shall be controlled with either a dimmer, an occupant sensor control, or other control that is installed or built into the fixture.

Exception: Lighting controls shall not be required for the following:

- Bathrooms
- Hallways
- Exterior lighting fixtures
- Lighting designed for safety or security

Reason: The purpose of this code change proposal is to increase lighting efficiency to better align with the current lighting market and upcoming changes to lighting standards.

DOE projects that light-emitting diode (LED) lighting will represent about half of the market share in 2020, and nearly 85% of the market share by 2030[1]. Goldman Sachs projects an even faster uptake of LEDs, projecting a full market penetration by the early 2020s[2]. The current definition of a “high efficacy lamp” in the energy code is outdated: it was added to the code in 2009, when LED market share was close to zero, and has not been updated since then. In fact, the definition no longer represents the “high efficacy” share of the market. New lighting standards will take effect in 2020 that will eliminate all bulbs on the market with efficiencies lower than 45 lumens per watt. Therefore, by the time the 2021 code is published, some of the bulbs currently defined by the IECC as “high efficacy” will be illegal to sell. Given these market and standard changes, the definition must be updated to remain relevant.

Once the updated federal standard takes effect, the baseline, least-efficient bulb on the market will no longer be an incandescent or even a halogen, but a compact fluorescent light bulb. In many cases, LEDs are close in price to – or even cheaper than - CFL alternatives while being a clearly superior product. CFLs contain mercury, are slow to come to full light, and few models are dimmable. In contrast, LEDs come in a wide range of light outputs, bulb shapes, color temperatures, socket types, do not contain mercury, and the vast majority of models are dimmable. Virtually all LEDs on the market today meet the 70 lumens per watt requirement specified in this proposal.

The table below summarizes a recent Home Depot search for a dimmable 60-watt equivalent bulb, one that gives off approximately 800 lumens of light. The LED bulb is significantly more efficient and longer-lasting than the CFL or halogen option. Recent searches found that sale prices of LED bulbs are often even lower than a halogen equivalent. Note that the CFL bulb is not dimmable; there was no equivalent dimmable CFL option. A separate search for dimmable CFL bulbs[3] shows that they are in the range of at least \$7 per bulb and not widely available. The halogen option will

not be legal to sell starting January 1, 2020.

Lighting Technology	Brand	Cost per Bulb	Lumens Per Watt	Estimated Annual Energy Cost	Lifetime	Dimmable?
LED	Philips[4]	\$1.54 (sale price)	84	\$0.84	22 years	Yes
		\$3.08 (full price)				
CFL	EcoSmart[5]	\$1.49	64	\$1.69	9 years	No
Halogen	Westinghouse[6]	\$2.10	18.1	\$5.06	0.9 years	Yes

The proposal also requires lighting controls, in the form of either a dimmer, occupancy control, or other such control (such as an automatic daylight sensor). Both dimmers and occupancy controls will save even more energy. Dimmers can reduce energy use by about 20%, while occupancy sensors reduce wasted energy by around 30%[7]. These controls are essentially permanent, with an extremely long lifetime. Connected occupancy controls, such as those in use with a home automation system, can add value and convenience to homeowners, as well.

[1] U.S. Department of Energy Building Technologies Office. "Solid State Lighting." September 2014. Retrieved on January 10, 2019 from <https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/energysavingsforecast14-summm.pdf>

[2] Goldman Sachs. "The Low Carbon Economy." November 28, 2016. Retrieved on January 10, 2019 from <https://www.goldmansachs.com/insights/pages/new-energy-landscape-folder/report-the-low-carbon-economy/report-2016.pdf>

[3] Home Depot (January 10, 2019). Retrieved from <https://www.homedepot.com/b/Lighting-Light-Bulbs-CFL-Bulbs/Dimmable/N-5yc1vZbmatZ1z0u4xv>

[4] Home Depot (January 10, 2019). Retrieved from <https://www.homedepot.com/p/Philips-60-Watt-Equivalent-A19-Dimmable-LED-ENERGY-STAR-Light-Bulb-Soft-White-with-Warm-Glow-4-Pack-479576/303967548>

[5] Home Depot (January 10, 2019). Retrieved from <https://www.homedepot.com/p/EcoSmart-60-Watt-Equivalent-Spiral-Non-Dimmable-CFL-Light-Bulb-Soft-White-4-Pack-ESBM8144/205487792>

[6] Home Depot (January 10, 2019). <https://www.homedepot.com/p/Westinghouse-42-Watt-Eco-Halogen-A19-Soft-White-Medium-Base-Light-Bulb-4-Pack-3687600/300620938>

[7] Powers, Alexis. "Congratulate Yourself on Achieving One Easy Energy-Saving Resolution." U.S. Department of Energy, Energy Saver blog. Retrieved on January 10, 2019 from <https://www.energy.gov/energysaver/articles/congratulate-yourself-achieving-one-easy-energy-saving-resolution>

Bibliography: [1] U.S. Department of Energy Building Technologies Office. "Solid State Lighting." September 2014. Retrieved on January 10, 2019 from <https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/energysavingsforecast14-summm.pdf>

[2] Goldman Sachs. "The Low Carbon Economy." November 28, 2016. Retrieved on January 10, 2019 from <https://www.goldmansachs.com/insights/pages/new-energy-landscape-folder/report-the-low-carbon-economy/report-2016.pdf>

[3] Home Depot (January 10, 2019). Retrieved from <https://www.homedepot.com/b/Lighting-Light-Bulbs-CFL-Bulbs/Dimmable/N-5yc1vZbmatZ1z0u4xv>

[4] Home Depot (January 10, 2019). Retrieved from <https://www.homedepot.com/p/Philips-60-Watt-Equivalent-A19-Dimmable-LED-ENERGY-STAR-Light-Bulb-Soft-White-with-Warm-Glow-4-Pack-479576/303967548>

[5] Home Depot (January 10, 2019). Retrieved from <https://www.homedepot.com/p/EcoSmart-60-Watt-Equivalent-Spiral-Non-Dimmable-CFL-Light-Bulb-Soft-White-4-Pack-ESBM8144/205487792>

[6] Home Depot (January 10, 2019). <https://www.homedepot.com/p/Westinghouse-42-Watt-Eco-Halogen-A19-Soft-White-Medium-Base-Light-Bulb-4-Pack-3687600/300620938>

[7] Powers, Alexis. "Congratulate Yourself on Achieving One Easy Energy-Saving Resolution." U.S. Department of Energy, Energy Saver blog. Retrieved on January 10, 2019 from <https://www.energy.gov/energysaver/articles/congratulate-yourself-achieving-one-easy-energy-saving-resolution>

Cost Impact: The code change proposal will increase the cost of construction

This proposal will increase the cost of construction due to the increased cost of dimmer switches or occupancy controls. However, there is little, if any, incremental cost to move from CFL to LED bulbs even today, and the costs of this technology will continue to decrease. Given the change in technology and the improved federal standards, by the time the 2021 code is adopted, there may be no incremental cost to purchase a LED bulb.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: 10 percent was needed for fans and special fixtures, the inclusion of occupancy controls, the control language is too simplistic, need more information on cost (Vote 11-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE145-19

Individual Consideration Agenda

Public Comment 1:

IECC@: 202 (New), R404.1 (IRC N1104.1), R404.2 (IRC N1104.2) (New)

Proponents:

Lauren Urbaneck, representing Natural Resources Defense Council (lurbaneck@nrdc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**DIMMER. (IRC N1101.6).** A control device that is capable of continuously varying the light output and energy use of light sources.~~

OCCUPANT SENSOR CONTROL. (IRC N1101.6). An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment or appliances to be regulated accordingly.

~~**R404.1 (IRC N1104.1) Lighting equipment (Mandatory).** All permanently installed lighting fixtures shall contain only high efficacy lamps.~~

R404.2 (IRC N1104.2) Lighting Controls (Mandatory). At least one permanently installed lighting fixtures in each of the following spaces shall be controlled with either a dimmer, an occupant sensor control with manual on capability and which automatically turns off lights within 20 minutes after all occupants have left the space, or other control that is installed or built into the fixture.

Exception: Lighting controls shall not be required for the following:

1. Bathrooms
2. Garages
3. Laundry Rooms
4. Utility Rooms
5. ~~Hallways~~
6. ~~Exterior lighting fixtures~~
7. ~~Lighting designed for safety or security~~

Commenter's Reason: This proposal should be approved as modified because it reduces energy waste from lighting being left on when no one is in these spaces. The proposed modification has been simplified and streamlined to address issues raised at the Committee Action hearing:

- The Committee raised concerns about requiring all lamps to meet the definition of a high efficacy lamp, citing concerns about federal preemption and about this requirement being inappropriate for some situations (refrigerators, range hoods, etc). The increased efficiency requirements have been removed from this proposal, since proposal RE7 accomplishes the goal of improving lighting efficiency. RE7 received a recommendation of Approve As Submitted from the Committee.
- The Committee raised questions about occupant satisfaction with dimmers and occupant sensor controls. To respond to this concern, the proposal has been restructured to remove dimmers, and to require occupant sensor controls in only certain rooms: bathrooms, garages, laundry rooms, and utility rooms. This resolves the issues discussed about dissatisfaction with occupancy sensors in kitchens, bedrooms, or

other living spaces.

- Furthermore, a minimum of just one permanently installed fixture per room is required to be controlled with an occupant sensor control, in order to account for instances like lights in showers, cabinet lighting, and other situations where sensor controls would be difficult to use. This is modeled directly on the requirements of California's Title 24 energy code, which has had a residential lighting sensor control requirement in place since 2013.

Bibliography: Home Depot (accessed 7/23/19), cost and energy use of a CFL bulb: <https://www.homedepot.com/p/Philips-100-Watt-Equivalent-T2-Twister-CFL-Light-Bulb-Daylight-Deluxe-4-Pack-433557/204855102>

Home Depot (accessed 7/23/19), cost of an occupancy sensor control: <https://www.homedepot.com/p/Leviton-Decorra-Motion-Sensor-In-Wall-Switch-Auto-On-2-5-A-Single-Pole-White-R12-IPS02-1LW/203826482>

California Statewide Codes and Standards Team (accessed 7/23/19), Residential Lighting, 2013 California Building Energy Efficiency Standards, October 2011: https://t24stakeholder.wpengine.com/wp-content/uploads/2017/10/2013_CASE-Report_Residential-Lighting.pdf

Powers, Alexis. "Congratulate Yourself on Achieving One Easy Energy-Saving Resolution." U.S. Department of Energy, Energy Saver blog. Retrieved on January 10, 2019 from <https://www.energy.gov/energysaver/articles/congratulate-yourself-achieving-one-easy-energy-saving-resolution>

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The California Utilities Statewide Codes and Standards Team analyzed the costs and energy savings from occupancy sensors prior to incorporating these measures into the 2013 version of Title 24. They found that, on average, a sensor costs around \$25 and provides a 30% energy savings over standard manual switching. A recent internet search found occupancy sensor controls can be purchased for as little as \$15-\$20. The 30% energy savings information is consistent with the values NRDC provided in our original proposal, via the Department of Energy.

The total incremental cost will vary by home, depending on the number of bathrooms, utility rooms, or laundry rooms the home has, and whether it has a garage. Given that the proposal is structured such that a minimum of one permanently installed lighting fixture is required to have an occupancy sensor control, the incremental cost could be limited to as little as \$80-\$100 per home.

The California Codes and Standards Team found that in most cases, a single sensor controls multiple bulbs. For example, if a sensor in a bathroom controls a vanity light with 4 CFL bulbs, the energy cost is around \$10-\$12/year. If that was cut by 30% due to the use of a sensor, the energy savings would pay for the incremental cost of the sensor in around 5 years, well within the life of the bulb and the sensor.

Public Comment# 1220

RE146-19

IECC: R202 (IRC N1101.6), R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

ELECTRIC VEHICLE. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

Add new text as follows:

R404.2 (IRC N1104.2) Electric vehicle ready parking (Mandatory). Where parking is provided, electric vehicle ready parking spaces shall be provided in compliance with Sections R404.2.1 and R404.2.2. Where more than one parking facility is provided on a site, electric vehicle ready parking spaces shall be calculated separately for each parking facility.

Exception: This section does not apply to parking spaces used exclusively for trucks or delivery vehicles.

R404.2.1 (IRC N1104.2.1) Electric vehicle ready parking spaces. Not less than two percent, but not less than one, parking spaces shall be electric vehicle ready parking and shall comply with Section R404.2.2.

Exception: Single-family and two-family dwelling units shall provide a not less than one electric vehicle ready parking space.

R404.2.2 (IRC N1104.2.2) Electric vehicle service equipment (EVSE) ready circuit. Each electric vehicle ready parking space shall be provided with a minimum 40-ampere branch circuit to accommodate a future dedicated Level 2 EVSE. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 240 volts or greater service. The circuit shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Reason: As of January 1, 2019, more than one million EVs are on U.S. roads. EEI and IEI estimate that the number of plug-in EVs will increase to about seven million by 2025. See EEI and IEI, "Plug-in Electric Vehicle Sales Forecast Through 2025 and the Charging Infrastructure Required," available at [http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20\(2\).pdf](http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20(2).pdf). BNEF and Energy Innovation have recently released projections that show accelerated growth in EVs as a percentage of new car sales beginning around the middle of the next decade. See BNEF, "Electric Vehicle Outlook: 2018," available at <https://bnef.turtl.co/story/evo2018?teaser=true>, and Energy Innovation, "The Future of Electric Vehicles in the U.S.," available at https://energyinnovation.org/wp-content/uploads/2017/10/2017-09-13-Future-of-EVs-Research-Note_FINAL.pdf. By 2040 BNEF estimates that EVs will account for 58% of all new car sales by 2040. See BNEF, "Electric Vehicles to Accelerate to 54% of New Car Sales by 2040," available at <https://about.bnef.com/blog/electric-vehicles-accelerate-54-new-car-sales-2040/>. A major driver of this steep EV sales trend will be a dramatic decrease in battery costs of more than 70 percent by 2030. See BNEF, "Electric Vehicle Outlook 2018."

The increase in EV sales will be accompanied by an increase in demand for on-site residential EV charging capacity. Up to 5.5 million chargers, which will be mostly installed in homes, will be required by 2025 to support a fleet of seven million EVs. See EEI and IEI, "Plug-in Electric Vehicle Sales Forecast Through 2025 and the Charging Infrastructure Required." In the near term this will likely involve the installation of Level 2 chargers, which require an additional 240-volt circuit. The cost of retrofitting a home to accommodate a Level 2 charger, which can recover the full range of a typical EV in 10 hours or less, will be a financial burden on homeowners. Adding a requirement for EV-ready parking spaces to the code will facilitate future Level 2 charger installations, which will eventually become practically ubiquitous, at a much lower cost.

Increased adoption of EVs will have a positive effect on overall U.S. household energy spending and carbon emissions. In terms of energy savings, EV fuel economy is, on average, more than three times more efficient than conventional gasoline-fueled counterparts. Even when compared over

the full lifecycle of fuel production and use, the average EV consumes less than half the energy per vehicle mile traveled. See InsideEVs, "Efficiency Compared: Battery-Electric 73%, Hydrogen 22%, ICE 13%," available at <https://insideevs.com/efficiency-compared-battery-electric-73-hydrogen-22-ice-13/>, and Argonne National Laboratory, "Greenhouse Gases, Regulated Emissions, and Energy use in Transportation Model," available at <https://greet.es.anl.gov/index.php>. NRDC and EPRI found that if 50 percent of personal vehicle miles traveled were powered by electricity in 2050, the U.S. would realize annual emissions reductions of 550 million metric tons of carbon dioxide. See NRDC, "Study: Electric Vehicles Can Dramatically Reduce Carbon Pollution from Transportation, and Improve Air Quality," available at <https://www.nrdc.org/experts/luke-tonachel/study-electric-vehicles-can-dramatically-reduce-carbon-pollution>. The ideal solution would get this code change in place by the time adoption rates are expected to accelerate, which would help facilitate adoption of EVs and therefore lead to more efficient energy consumption and lower household carbon emissions.

Bibliography: Argonne National Laboratory, "Greenhouse Gases, Regulated Emissions, and Energy use in Transportation Model," available at <https://greet.es.anl.gov/index.php>. Last accessed January 9, 2019.
InsideEVs, "Efficiency Compared: Battery-Electric 73%, Hydrogen 22%, ICE 13%," October 2, 2017, available at <https://insideevs.com/efficiency-compared-battery-electric-73-hydrogen-22-ice-13/>. Last accessed January 9, 2019.

Bloomberg New Energy Finance, "Electric Vehicle Outlook: 2018," available at <https://bnf.turtl.co/story/evo2018?teaser=true>. Last accessed January 9, 2019.

Bloomberg New Energy Finance, "Electric Vehicles to Accelerate to 54% of New Car Sales by 2040," July 6, 2017, available at <https://about.bnef.com/blog/electric-vehicles-accelerate-54-new-car-sales-2040/>. Last accessed January 9, 2019.

Edison Electric Institute and Institute for Electric Innovation, "Plug-in Electric Vehicle Sales Forecast Through 2025 and the Charging Infrastructure Required," June 2017, pgs. 1 and 9, available at [http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20\(2\).pdf](http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20(2).pdf). Last accessed January 9, 2019.

Energy Innovation, "The Future of Electric Vehicles in the U.S., September 27, 2017, pg. 3, available at https://energyinnovation.org/wp-content/uploads/2017/10/2017-09-13-Future-of-EVs-Research-Note_FINAL.pdf. Last accessed January 9, 2019.

NRDC, "Study: Electric Vehicles Can Dramatically Reduce Carbon Pollution from Transportation, and Improve Air Quality," available at <https://www.nrdc.org/experts/luke-tonachel/study-electric-vehicles-can-dramatically-reduce-carbon-pollution>. Last accessed January 9, 2019.

Realtor.com, "Electric Car Charger Installation in Your Home: True Costs—and What You Need to Know," November 2, 2017, available at <https://www.realtor.com/advice/home-improvement/installing-electric-vehicle-charger/>. Last accessed January 9, 2019.

Cost Impact: The code change proposal will increase the cost of construction. The additional branch circuit and associated wiring and conduit required to make parking spaces EV-ready will incrementally increase the cost of construction. But the cost of a retrofit to add the electrical panel capacity for a common Level 2 charger will be much higher—up to \$2,000. See Realtor.com, "Electric Car Charger Installation in Your Home: True Costs—and What You Need to Know," available at <https://www.realtor.com/advice/home-improvement/installing-electric-vehicle-charger/>.

RE146-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal does not save energy, this should not be in the IECC it should be part of an above-code program, and it should not be mandatory for single family (Vote: 7-4).

Assembly Action:

None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE146-19

Individual Consideration Agenda

Public Comment 1:

IECC@: APPENDIX X (New), X.1 (New)

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

APPENDIX X ELECTRIC VEHICLE CHARGING

X.1 Electric Vehicle charging spaces. Where new single-family dwelling units include parking, a dedicated electric vehicle 40-ampere, 208/240-volt branch circuit to the parking shall be provided.

The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY".

Commenter's Reason: Some jurisdictions will choose not to require an EV circuit, therefore this is an appendix. This appendix is for the jurisdictions choosing to be "EV ready".

Retrofit of EV circuits can be very expensive where a path for the circuit must be created; for example, cutting, then covering, a path for the EV circuit under concrete. Building this circuit during construction of the new home is the least expensive way to provide that circuit in new construction.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Even though it is the least expensive time to do it, adding EV circuits will add cost.

Public Comment# 2162

Public Comment 2:

IECC@: R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.2 (IRC N1104.2) Electric vehicle ready parking (Mandatory). Where parking is provided, electric vehicle ready parking spaces shall be provided in compliance with Sections R404.2.1 and R404.2.2. Where more than one parking facility is provided on a site, the required number of electric vehicle ready parking spaces shall be calculated separately for each parking facility.

Exception: This section ~~does~~ shall not apply to short-term parking spaces used exclusively for trucks or delivery vehicles.

R404.2.1 (IRC N1104.2.1) Electric vehicle ready parking spaces. Not less than ~~two~~ one percent, but not less than one, parking spaces shall be electric vehicle ready parking and shall comply with Section R404.2.2.

Exception: Single-family and two-family dwelling units shall provide ~~a~~ not less than one electric vehicle ready parking space.

R404.2.2 (IRC N1104.2.2) Electric vehicle service equipment (EVSE) ready circuit. Each electric vehicle ready parking space shall be provided with a minimum ~~40~~ 50-ampere branch circuit to accommodate a future dedicated Level 2 EVSE. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 240 volts or greater service. The circuit shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Commenter's Reason: This modification will improve and clarify the language in the proposal. It will also have language that is consistent with the language approved for CE 217, Part I.

This modification will also reduce the costs of this proposal compared to the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment will reduce the cost increase of the original proposal by reducing the number of parking spaces required to be EV ready.

Public Comment# 1367

Public Comment 3:

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason: The Committee disapproved this proposal (7-4) based largely on its erroneous belief that the proposal would not save energy. EV's are well documented to save transportation energy. In addition, they complement "smart" buildings by providing the means to enhance grid resiliency through ancillary services (like frequency regulation) and renewable energy integration.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The additional branch circuit and associated wiring and conduit required to make parking spaces EV-ready will incrementally increase the cost of construction. But the cost of a retrofit to add the electrical panel capacity for a common Level 2 charger will be much higher—up to \$2,000. See Realtor.com, "Electric Car Charger Installation in Your Home: True Costs—and What You Need to Know," available at <https://www.realtor.com/advice/home-improvement/installing-electric-vehicle-charger/>.

Public Comment# 1555

RE147-19

IECC: R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New), R404.2.3 (IRC N1104.2.3) (New)

Proposed Change as Submitted

Proponents: Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new text as follows:

R404.2 (IRC N1104.2) Electric readiness (Mandatory) Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 and R404.2.2. All water heating systems shall comply with Section R404.2.3.

R404.2.1 (IRC N1104.2.1) Receptacle. A dedicated 125-volt, 20-amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, shall be provided within 3 feet from each gas or propane water heater, dryer, and conventional cooking equipment, accessible with no obstructions.

R404.2.2 (IRC N1104.2.2) Electrification-ready circuits. Both ends of the unused conductors shall be labeled with the word "SPARE" and be electrically isolated. A single pole circuit breaker space shall be reserved in the electrical panel adjacent to each circuit breaker for the branch circuit and labeled with the words "FUTURE 240V USE."

R404.2.3 (IRC N1104.2.3) Water heater space. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available within 3 feet of the water heater.

Exception: The water heater space requirement does not need to be met where a heat pump water heater is installed.

Reason: This proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances and water heating equipment. By ensuring that a home built with gas or propane can easily accommodate future electric appliances and equipment, this proposal protects homeowners from future costs, should natural gas become less affordable or even unavailable over the life of the building. As the electric grid becomes cleaner, and high-efficiency electric heat pump technology increasingly offers utility bill and pollution reduction benefits over gas, more customers may want to transition from natural gas to electric space and water heating. Federal, state, and local environmental and public health policies may also encourage, or even require the transition in some areas over the life of the building. Electric-ready requirements will protect customers from potential high retrofit costs.

Cost Impact: The code change proposal will increase the cost of construction. The cost of meeting these electric-ready requirements when the house is being built, walls are open, and the trades are already on-site, is marginal. In comparison, the cost of retrofitting a building for these requirements can be orders of magnitude higher and act as a barrier for the homeowner to choose electric appliances. Not making new buildings electric-ready would leave homeowners exposed to potentially high retrofit costs in the future and will greatly inhibit customer choice.

RE147-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Although in support of the concept, it impacts consumer choice, and sizing wires belongs in electrical code not energy code. Future proofing does not belong in the minimum code (Vote: 9-2).

Assembly Action:

None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE147-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.1 (New), R404.2.2 (New), R404.2.3 (New), R404.2.3 (IRC N1104.2.3) (New)

Proponents:

Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.2 (IRC N1104.2) Electric readiness (Mandatory) Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 through R404.2.3 ~~R404.2.1 and R404.2.2~~. All water heating systems shall comply with Section R404.2. ~~43~~.

~~**R404.2.1 (IRC N1104.2.1) Receptacle.** A dedicated 125-volt, 20-amp electrical receptacle that is connected to the electric panel with a 120/240-volt 3-conductor, 10-AWG copper branch circuit, shall be provided within 3 feet from each gas or propane water heater, dryer, and conventional cooking equipment, accessible with no obstructions.~~

~~**R404.2.1 Household Ranges and Cooking Appliances.** An individual branch circuit outlet with a minimum rating of 250-volts, 40-amperes shall be installed within three feet of each gas or propane range or permanently installed cooking appliance.~~

~~**R404.2.2 Household Clothes Dryers and Water Heaters.** An individual branch circuit outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane household clothes dryer and water heater.~~

~~**R404.2.3 R404.2.2 (IRC N1104.2.2) Electrification-ready circuits.** The unused conductors required by Section s R404.2.1 or R404.2.2 shall be labeled with the word "spare." Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Section s R404.2.1 or R404.2.2 shall be included in the load calculations of the original installation.~~

~~**R404.2.3 (IRC N1104.2.3) Water heater space.** An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available surrounding or within 3 feet of the installed water heater.~~

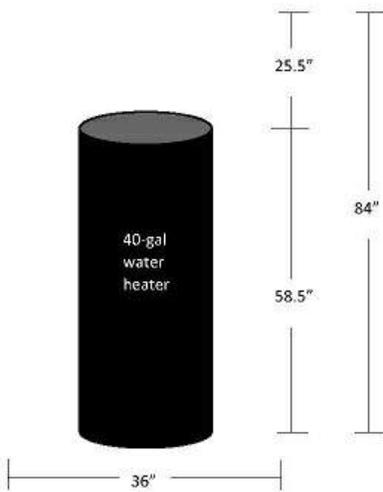
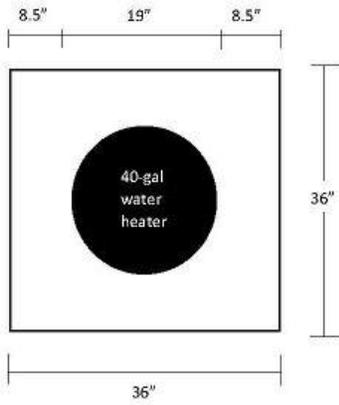
~~**Exception:** The water heater space requirement does not need to be met where a heat pump water heater or tankless water heater is installed.~~

~~**Commenter's Reason:** We request approval as modified, as this proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances. The Committee expressed their support for this concept, but raised questions about some of the technical language of this proposal; the modification proposed here addresses these concerns.~~

~~The proposed modifications address the comments raised by the Committee as follows:~~

- ~~• The technical language related to electrical circuits and electrification-ready circuits has been clarified, in collaboration with the National Electrical Manufacturers Association.~~
- ~~• The water heater space requirement has been clarified. The intent of the water heater space requirement is to ensure that there is sufficient room for future installation of a heat pump water heater. The dimensions are specified by the heat pump water heater manufacturers. The attached illustration represents the typical dimensions of a 40 gallon gas water heater. In this situation, there would need to be just 8.5 inches clearance on either side of the water heater, and approximately 2' of clearance on top of the water heater in order to meet the space requirements. [INSERT ATTACHMENT HERE]~~
- ~~• An exception has been added to clarify that the water heater space requirement does not apply when a tankless water heater is installed, as tankless products are often installed in close proximity to the hot water use in constrained spaces.~~

By ensuring that a home built with gas or propane can easily accommodate future electric appliances, this proposal protects homeowners from future costs, should natural gas become less affordable or even unavailable over the life of the building. As the electric grid becomes cleaner, and high-efficiency electric heat pump technology increasingly offers utility bill and pollution reduction benefits over gas, more customers may want to transition from natural gas to electric space and water heating. Federal, state, and local environmental and public health policies may also encourage, or even require the transition in some areas. Electric-ready requirements will protect customers from potentially high retrofit costs.



Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The cost of retrofitting a building for electrification can be orders of magnitude higher than adding the appropriate circuits when the house is being built. Exact cost estimates are not available and will vary by home. However, doing this work while the walls are open and the trades are already on site will unquestionably save the cost of additional drywall and finishing work. Furthermore, the additional hassle of retrofitting may act as a barrier for the homeowner to choose electric appliances in the future. Therefore, allowing the homeowner future flexibility at the time of construction is critical. Failing to make new buildings electric-ready would leave homeowners exposed to potentially high retrofit costs.

RE148-19

IECC: R404.1.1 (IRC N1104.1.1) (New)

Proposed Change as Submitted

Proponents: Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

2018 International Energy Conservation Code

Add new text as follows:

R404.1.1 (IRC N1104.1.1) Exterior lighting. Connected exterior lighting for Group R-2, R-3 and R-4 buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.

Exceptions:

- 1.Solar-powered lamps not connected to any electrical service.
- 2.Luminaires controlled by a motion sensors.

Reason: The IECC does not have any specific requirements for exterior lighting for residential buildings. This may not be a significant issue for single-family homes, duplexes and townhomes, but it is quite significant for Type-R occupancies like multifamily that are far more likely to have parking lots and other exterior lighting like their counterparts subject to the commercial code. A 4-story multifamily building with exactly the same systems and layout would therefore be subject to exterior lighting requirements while a 3-story variation would not. This creates a loophole in the code for low-rise R-occupancies.

This proposal directs exterior lighting for these occupancies to the commercial code and its LPD requirements. Small R-occupancy buildings are little different than small commercial buildings which are already subject to those requirements. The proposal exempts solar-powered lighting and any lighting controlled by a motion sensor.

When applied to the low-rise multifamily prototype developed by Pacific Northwest National Laboratories for the code determination studies, this requirement saved up to 0.5% (based on climate zone) whole building energy over the 2015 IECC. Since both 2018 and 2015 lack exterior lighting requirements, this is a reasonable approximation of savings.

Cost Impact: The code change proposal will increase the cost of construction

This will increase the cost of construction. However, the proposal refers only R-occupancies to the existing commercial exterior lighting requirements, which already cover smaller commercial buildings.

For example, a base light fixture cost for a 70 W halogen fixture is \$118 .00 (<https://www.lightingsupply.com/stonco-sla71mal-6>) and the cost for an enhanced 80 W LED light fixture that will meet the proposed efficacy requirements is \$158.33 (<https://www.lightingsupply.com/best-lighting-products-ledmpal80-t-5k>)

RE148-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It references commercial provisions some of which do not apply. Recommended return with a public comment fine-tuning the proposal (Vote 7-4).

Assembly Action:

None

RE148-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R404.1.1 (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.1.1 (IRC N1104.1.1) Exterior lighting. Connected exterior lighting for ~~Group R-2, R-3 and R-4 buildings~~ residential buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.

Exceptions:

1. One and two family residential
- ~~2.~~ Solar-powered lamps not connected to any electrical service.
- ~~3.~~ Luminaires controlled by a motion sensors.
4. Lamps and luminaires that comply with Section R404.1.

Commenter's Reason: The Public Comment makes two modifications based on the IECC Residential Code Development Committee feedback. The first modification deletes the reference to the International Residential Code as this requirement is focused on residential buildings with common parking areas and shared walkways found in multifamily projects. The second correction of the proposal recognizes that exterior lighting in dwelling units, e.g. patio lighting, will need to comply with Section R404.1 high efficacy lighting. Lighting that complies with this requirement should not be required to comply with exterior lighting power allowances as required by the commercial provisions of the IECC.

The IECC does not have any specific requirements for exterior lighting for residential buildings. This may not be a significant issue for single-family homes, duplexes and townhomes, but it is quite significant for Type-R occupancies like multifamily that are far more likely to have parking lots and other grounds lighting like their counterparts subject to the commercial code. This proposal introduces an efficiency requirement for large wattage exterior luminaires. The 50W threshold ensures that this requirement will apply almost exclusively to lighting used in a commercial-like site lighting application and not the smaller lights common in single-family homes, duplexes and townhomes and other lighting that serves a more decorative function. The proposal also exempts solar-powered lighting and any lighting controlled by a motion sensor.

The proposal is modeled on language was in the 2012 version of the IECC for commercial buildings. It defines the building grounds lighting, which was used in the IECC but not defined, with a definition utilized in ASHRAE Standard 90.1.

When applied to the low-rise multifamily prototype developed by PNNL for the code determination studies, this requirement saved up to 0.5% whole building energy.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This will increase the cost of construction. However, the proposal refers only R-occupancies to the existing commercial exterior lighting requirements, which already cover smaller commercial buildings.

For example, a base light fixture cost for a 70 W halogen fixture is \$118 .00 (<https://www.lightingsupply.com/stonco-sla71mal-6>) and the cost for an enhanced 80 W LED light fixture that will meet the proposed efficacy requirements is \$158.33 (<https://www.lightingsupply.com/best-lighting-productsledmpal80-t-5k>).

When applied to the low-rise multifamily prototype developed by Pacific Northwest National Laboratories for the code determination studies, this requirement saved up to 0.5% (based on climate zone) whole building energy over the 2015 IECC. Since both 2018 and 2015 lack exterior lighting requirements, this is a reasonable approximation of savings.

Public Comment# 1875

Public Comment 2:

IECC@: R404.1.1 (IRC N1104.1.1) (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.1.1 (IRC N1104.1.1) Exterior lighting. Connected exterior lighting for Group R-2, R-3 and R-4 buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.

Exceptions:

1. Detached one- and two family dwellings
2. Townhouses
- ~~3.~~ Solar-powered lamps not connected to any electrical service.
- ~~4.~~ Luminaires controlled by a motion sensors.

Commenter's Reason: The proponent is correct that R2, R3, and R4 projects are built under the residential provisions of the IECC. We need to recognize that they are commercial type projects with parking lots. I believe by exempting the single family, duplexes and townhouses from the requirement should alleviate any of the committee's concerns.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. While most of these projects are provided with exterior lighting anyway, they may not be provided with the controls required by the code. There may be an increase in cost for providing the controls.

Public Comment# 1824

RE151-19

IECC: R405.2 (IRC N1105.2) , ICC Chapter 6 (IRC Chapter 44)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R405.2 (IRC N1105.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Section R401.2 be met. The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table R402.1.1 or R402.1.3 of the 2009 International Energy Conservation Code. Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

Add new text as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

IECC-2009: International Energy Conservation Code

Reason: The purpose of this code change is to help ensure long-term energy savings and occupant comfort by applying a reasonable, consistent minimum mandatory thermal envelope backstop across the IECC's two performance-based compliance paths. Since 2015, the newest IECC compliance path, the Energy Rating Index (R406), has already included a minimum mandatory thermal envelope backstop based on the 2009 IECC prescriptive requirements. While a minimum backstop is most important for the ERI, it would also be useful if applied to the simulated performance alternative in Section R405. This proposal will accomplish this objective.

An important part of the logic behind the minimum thermal envelope requirements for the ERI applies to the performance path in Section R405 as well -- a well-built thermal envelope provides long-term energy savings and improved comfort for occupants over the lifetime of the home, and upgrades to the thermal envelope are easiest to incorporate (and most cost-effective) at construction. This is consistent with the intent of the IECC set forth in Section R101.3. Specifically, the IECC is intended to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building." Regardless of the compliance option selected by the code user, the IECC should require a reasonable minimum level of performance by the home's permanent thermal envelope. As a result, this proposal would apply the same minimum mandatory requirements, including envelope requirements, to Section R405 compliance as currently apply to Section R406 compliance.

To our knowledge, the 2009 IECC backstop in Section R406.2 has been adopted by every state that has adopted the ERI as part of the 2015 or 2018 IECC. A trade-off backstop recognizes the crucial importance of a reasonably efficient thermal envelope, irrespective of the efficiency tradeoffs among various other building components. While we would prefer an even more robust backstop than the 2009 prescriptive requirements (such as the 2015 requirements, which were established in 2018 for ERI compliance that includes on-site generation), the 2009 requirements are at least a reasonable starting place and are consistent with the current backstop for ERI.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Because this proposal only establishes a trade-off backstop to an alternative compliance path and not a prescriptive code requirement (the prescriptive requirements are already much more efficient than the proposed new backstop levels), and because most homebuilders are likely already meeting or exceeding these requirements, we conclude that there will not necessarily be any cost impact.

RE151-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: We do not need a backstop, the backstop is the reference design (Vote 11-0).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: R405.2 (IRC N1105.2)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R405.2 (IRC N1105.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Section R401.2 be met. ~~The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table R402.1.1 or R402.1.3 of the 2009 International Energy Conservation Code. The proposed total building thermal envelope UA which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum glazed fenestration SHGC permitted in Climate Zones 1 through 3 shall be 0.30.~~ Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

$$UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}} \quad \text{Equation 4-1}$$

Commenter's Reason: This proposal should be approved as submitted or as modified because it would provide an envelope backstop that would help maintain a reasonable level of building envelope efficiency in homes constructed under the performance path. An efficient thermal envelope is crucial to a comfortable and energy efficient home and minimum levels of envelope efficiency should not be traded off under alternative compliance methods like the performance path. This principle has already been recognized in the ERI path and the purpose of this proposal is to apply this approach to the performance path as well. The original reason for the proposal further explains the benefits of an envelope backstop for the performance path.

The proposed modification would provide additional flexibility for builders by permitting a Total UA-based backstop instead of requiring certain R-values for each component and includes appropriate SHGC requirements for fenestration. The proposed modification would match the language recommended for approval in RE150-19, making the minimum thermal envelope requirements the same for both the Simulated Performance Alternative and the Energy Rating Index (without on-site generation). This modification would also reference the current edition of the IECC, instead of a static reference to the 2009 IECC.

The Committee reason confuses the proposed backstop and the standard reference design in the performance path, stating that "We do not need a backstop, the backstop is the reference design." There is a big difference between the reference design, which merely establishes the baseline home for potential trade-offs, and a backstop requiring minimum performance for specific building elements. The performance path baseline is based on the prescriptive requirements of the current IECC, which are substantially more stringent than the proposed minimum values for the backstop, and elements of the standard reference design may be traded away. The backstop, on the other hand, is a more lenient set of requirements because it is intended as a "worst case scenario" for trade-offs and cannot be further traded away. When the ERI was added to the IECC in the 2015 IECC, it was widely recognized that a compliance path with so many trade-off opportunities would need to require compliance with mandatory measures and some amount of efficiency in the thermal envelope. Thus, minimum prescriptive requirements were included as a backstop for the efficiency of thermal envelope components. This backstop has been adopted by every state that has incorporated the ERI as part of a 2015 or 2018 IECC adoption.

This proposal is important for the same reasons that the Energy Rating Index includes a thermal envelope backstop. The efficiency of the permanent thermal envelope must be maintained at a reasonable level, since envelope components typically have a much longer life and are more likely to remain unaltered over the useful life of the building. The proposed backstop in this code change is a good first step in that it reflects a modest level of protection given the current performance path. Adopting the modification above would apply the same Total UA-based backstop to both the ERI and the performance path.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction As stated in the original proposal, because this only establishes a trade-off backstop to an alternative compliance path and not a prescriptive code requirement (the prescriptive requirements are already much more efficient than the proposed new backstop levels), and because most

homebuilders are likely already meeting or exceeding these requirements, we conclude that there will not necessarily be any cost impact.

Public Comment# 1485

RE153-19

IECC@: R405.3 (IRC N1105.3)

Proposed Change as Submitted

Proponents: Ted Williams, representing American Gas Association (twilliams@aga.org)

2018 International Energy Conservation Code

Revise as follows:

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be ~~permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier 3.16 for electricity and 1.1 for fuels other than electricity shall be 1.1.~~ or other multipliers for national or regional annual average energy consumption from nationally-recognized and validated data sources.

Reason: The proposed change is consistent with the proposed change to C407.3 and is based upon the source energy metric usage in Federal energy programs including Energy Star for Commercial Buildings and Home Energy Score. This revised exception provides the only means of assessing energy performance on fuel cycle energy consumption and ultimately carbon footprints since site energy metrics alone cannot account for these upstream energy system losses. In addition, the allowance in the proposed exception language for use of "other multipliers" addresses a persistent criticism of national average multipliers, which do not reflect regional or local mixes of renewable energy in meeting building demands, and encourages authorities having jurisdiction to use locally-relevant multipliers that are available from utilities and other sources. Also, greater usefulness of the exception is critical since the basic requirements of R405.3 focusing on energy cost is not consistent with the intent of the IECC as stated in R101.3, which addresses energy use and conservation, not energy cost.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal would not increase the cost of construction since the proposal is for changes to an exception. If the use of source energy metrics allows more alternatives for achieving energy performance improvements, it may decrease construction costs ultimately.

RE153-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Concern with language and there is confusion about the proper multiplier (Vote: 11-0).

Assembly Action:

None

RE153-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R405.3 (IRC N1105.3)

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: ~~Where jurisdictions use source energy rather than energy cost as a metric, the energy use consumption shall be based on upon source energy expressed in Btu or Btu per square foot of conditioned floor area and calculated using the source multipliers of shall be 3.16 2.95 for grid-supplied electricity, 1.09 for natural gas, 1.15 for propane and 1.19 for fuel oil, or using and 1.1 for fuels other than electricity, or other multipliers for national, state, or regional, or local annual average energy consumption and published in governmental sources, from nationally-recognized and validated data sources.~~

Commenter's Reason: The Committee reasoning that there is "too much confusion over source energy factors" ignores the fact that factors for primary fuels are well established in literature and building rating tools, and the grid electricity factor of 2.95 has been used in the Pacific Northwest National Laboratory (PNNL) May 2019 report, "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," establishing use of this factor as a matter of federal analytical policy and procedures. While this factor can be changed as an update, to date no documented effort has been extended to challenge use of this factor. "Consensus" in "standards" regarding this factor is a political and market argument among stakeholder, meanwhile the federal government and other authorities are proceeding with using these factors in building rating.

Bibliography: Taylor, T., Mendon, V., Zhan, M., and Liu, B., "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," DOE/EERE, May 2019.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. By allowing the use of more reasonable source energy metrics for performance analysis of buildings, greater flexibility in building design would be facilitated and construction cost savings would be realized.

Public Comment# 2166

RE154-19

IECC: R405.3 (New), TABLE R405.3.1 [IRC N1105.3.1] (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org); Keith Dennis, representing NRECA (keith.dennis@nreca.coop)

2018 International Energy Conservation Code

Revise as follows:

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: The energy use based on site energy or source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. ~~The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~ estimate multipliers for energy sources shall be taken from Table R405.3.1.

Add new text as follows:

**TABLE R405.3.1 (IRC N1105.3.1)
SOURCE ENERGY ESTIMATED MULTIPLIERS**

SOURCE ENERGY TYPE	ESTIMATED SOURCE MULTIPLIER^a
Electricity, Imported, General Grid	2.61
Electricity, Imported, Local or National RPS	Greater of [2.61 x (1 - RPS%)] or 1.00
Electricity, Off-Site Delivered Renewable	1.00
On-Site Renewable Electricity, used by building or exported	1.00
On-Site Stored Renewable Electricity (used by building or exported)	1.00
Natural Gas, domestic, no flaring/venting	1.09
Natural Gas, domestic, with 20% flaring/venting	1.37
Natural gas, imported as LNG	1.25
Fuel Oil (1, 2, 4, 5, 6, Diesel, Kerosene), domestic	1.19
Fuel Oil, imported from overseas	1.45
Propane, Liquid Propane, domestic	1.15
Propane, Liquid Propane, domestic, with 20% flaring/venting	1.49
Steam, Non-Renewable	1.45
Steam, Renewable	1.00
Hot Water, Non-Renewable	1.35
Hot Water, Renewable	1.00
Chilled Water, Non-Renewable	1.04
Chilled Water, Renewable	1.00
Coal or Other, domestic	1.05

a. Values represent averages for the United States.

Reason: The world of energy production and energy storage and choices of energy supply is changing rapidly. The current language is outdated and does not account for all of the changes going on and needs to be revised.

This proposal will make the provision more flexible for building designers, building owners, and code officials. By allowing the use of site energy, which was allowed in previous versions of the IECC, the performance path can be based on real measured data. By updating source energy estimates, there will be more information provided to code officials and building owners.

More buildings are producing and storing energy on-site, so it does not make technical or analytical sense to require the use of outdated "source energy" estimates.

Site Energy

Allowing the use of site energy is more appropriate for buildings that are producing or storing energy on-site. In the future, many buildings will be producing energy and storing energy, along with consuming energy. Building systems may be consuming energy that was produced from an off-site energy grid and/or produced from an on-site energy production system and/or delivered from an off-site energy storage system (e.g., a grid battery or EV battery) and/or delivered from an on-site energy storage system, (e.g., and battery or fuel storage tank or thermal energy storage system). At the same time, the building may be producing energy that is used by building equipment, sent to an on-site energy storage system, or exported to another building (or buildings) or to the energy grid.

In a letter to DOE, ASHRAE said:

"the Society believes that the multiple and varying weighting factors and algorithms required for estimating source energy conversions are often inconsistent and ultimately cloud and complicate understanding. Since source energy conversion factors vary widely from place to place and across time, the use of fixed national average conversion factors could lead to inconsistent estimates of consumption."

"Thus, in this case ***the best method for determining if a building is a NZEB is to look at the energy crossing the boundary at the site of the building; hence "site" energy is the best choice to use.***" (emphasis added)

Site energy was part of the exception for many years until it was removed. There are many reasons to allow site

energy to be used as an alternative to source energy or energy costs:

-Site energy is an actual metric that can be measured and verified by code officials, while source energy is an estimate.

-Site energy information is credible, as it is shown on customers' energy bills on a monthly basis and used in other consensus-based code documents, such as ASHRAE 90.1, use site energy metrics for efficiency requirements.

-DOE uses site energy information in many of its energy efficiency and energy consumption publications, such as the Residential Energy Consumption Survey. DOE uses site energy for its appliance energy efficiency standards program and the FTC uses site energy on the yellow EnergyGuide labels found on consumer appliances. EPA uses site energy to determine if an appliance or home qualifies for the Energy Star program.

-Site energy is reliable, since it can be measured by utilities, consumers, and independent 3 parties. In terms of energy efficiency upgrades, consumers rely on site energy information (amount used by older appliance or equipment compared to new appliance or equipment) to help them make energy efficiency decisions.

-Site energy is replicable, as the units of measurement (kWh, therms, gallons, Btu's) can be used throughout the United States and are familiar to consumers on their monthly energy bills. Source energy is not replicable, as different estimates must be used for different energy sources, and different entities can make different assumptions about upstream production and delivery of different energy sources.

-Site energy is transparent and easy to understand. It can be based on meter readings or DOE test procedures or FTC EnergyGuide labels or Energy Star labels. It is the metric that allows people to easily compare energy efficiency options in the marketplace. It is the metric that allows people to make good economic choices when faced with competitive alternatives.

Source Energy Estimates

There are many ways to estimate upstream energy losses. The energy production industry is very dynamic and subject to significant changes. In the United States in 2018, there was a record amounts of natural gas produced from hydraulic fracturing production techniques. In 2018, there was a record amount of oil produced and imported from oil sands production. In 2018, there was a record amount of electricity produced from renewable forms of energy and a record amount of electricity produced by combined-cycle natural gas turbines.

The values that are currently shown should be deleted and not used. The values shown are not consistent with values shown in other published documents. Many documents and articles have been published over the past several years with source energy estimates as shown in the bibliography. The current values in the IECC do not match and cannot be substantiated with any of these published documents.

Different fossil fuels have different upstream source estimates. In the current IECC, all fossil fuels are assumed to have the same multiplier. In other documents, there is a large and statistically significant variation in the upstream estimates that will have a significant impact on energy performance results. As one example, for fuel oil and propane, EPA's Portfolio Manager uses a factor of 1.01 for both, while NREL used estimated values of 1.158 and 1.151, while IGCC 2015 uses 1.19 for fuel oil and 1.15 for propane. The use of 3.16 for electricity is overstated for many parts of the United States and does not account for significant regional differences or the increase in the use of renewable power generation and combined cycle gas turbines.

In other publications and web sites, the estimates for electricity are shown on a national basis, a regional basis, or a state by state basis. This is due to the variety of electric generation techniques which have upstream energy losses that can vary by orders of magnitude based on local conditions, regional conditions, physical location, season, month, week, or day, as well as hourly fluctuations in the amount of sunlight or wind speed.

The revisions to the values are based on reports published by the US Energy Information Administration, the US Department of Energy, the US Environmental Protection Agency, national labs, and other public sources of information. It is a technical fact that there are significant differences in terms of upstream estimates for electricity as well as fossil fuels. The new estimates provide more defensible and accurate estimates.

Bibliography: National Renewable Energy Laboratory NREL/TP-550-38617 "Source Energy and Emission Factors for Energy Use in Buildings" (June 2007)

American Gas Association EA 2009-3 "A Comparison of Energy Use, Operating Costs, and Carbon Dioxide Emissions of Home Appliances" (October 2009)

Environmental Protection Agency "Energy Star Performance Ratings Methodology for Incorporating Source Energy Use" (August 2009 and 2017 update)

National Renewable Energy Laboratory NREL/TP-550-47246 "Building America Research Benchmark Definition" (January 2010)

International Code Council "International Green Construction Code" (May 2015)

American Gas Association "Dispatching Direct Use", Table 1, (November 2015)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal only provides another option for the simulation used for the performance path.

RE154-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: While we need to move toward metric for carbon this proposal is not the right one (Vote: 11-0).

Assembly Action:

None

RE154-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R405.3 (IRC N1105.3), TABLE R405.3.1 (IRC N1105.3.1) (New)

Proponents:

Charles Foster, representing EEl (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: The energy use based on site energy or source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy estimate multipliers for energy sources shall be taken from Table R405.3.1.

**TABLE R405.3.1 (IRC N1105.3.1)
SOURCE ENERGY ESTIMATED MULTIPLIERS**

SOURCE ENERGY TYPE	ESTIMATED SOURCE MULTIPLIER^a
Electricity, Imported, General Grid	2.61
Electricity, Imported, Local or National RPS	Greater of [2.61 x (1 - RPS%)] or 1.00
Electricity, Off-Site Delivered Renewable	0+0.00
On-Site Renewable Electricity, used by building or exported	0+0.00
On-Site Stored Renewable Electricity (used by building or exported)	0+0.00
Natural Gas, domestic, no flaring/venting	1.09
Natural Gas, domestic, with 20% flaring/venting	1.37
Natural gas, imported as LNG	1.25
Fuel Oil (1, 2, 4, 5, 6, Diesel, Kerosene), domestic	1.19
Fuel Oil, imported from overseas	1.45
Propane, Liquid Propane, domestic	1.15
Propane, Liquid Propane, domestic, with 20% flaring/venting	1.49
Steam, Non-Renewable	1.45
Steam, <u>Produced by Renewable Electric</u>	0+0.00
Hot Water, Non-Renewable	1.35
Hot Water, <u>Produced by Renewable Electric</u>	0+0.00
Chilled Water, Non-Renewable	1.04
Chilled Water, <u>Produced by Renewable Electric</u>	0+0.00
Coal or Other, domestic	1.05

a. Values represent averages for the United States.

Commenter's Reason: There are three metrics typically used in the expression of energy efficiency; site energy, cost, and source energy. Site energy is a measured value (think electric meter, gas meter, etc.). It is typically expressed in terms of kilowatt hours or therms of gas. Because it is a measured value, it is regarded as the most precise metric of the three. For the same reason, it also serves as the basis for both energy cost and source energy.

Energy cost, on the other hand, is the product of multiplying the site energy value in representative units by the cost of such units. (kilowatt hours X cost per kilowatt hour, etc.) It is also the most meaningful metric to consumers.

Source of energy estimates are achieved by multiplying site energy by a source energy multiplier. Source energy multipliers attempt to express the raw energy input required to deliver one unit of energy to an ultimate end use. Because of the complexities inherent with the calculus that outsource energy factors, including the numerous assumptions, source energy is the least precise of the three metrics.

Overwhelmingly, codes and standards adopted by jurisdictions have used energy costs as the metric used to demonstrate compliance. In 2009, the IECC first allowed source energy as an exception to cost.

Given that source energy is a less precise approach than site energy, this proposal simply argues to allow for the more efficient site energy metric its source energy is to remain in the code.

In addition, work by ASHRAE (Std. 189.1, WG7.5) has resulted in the use of a "0" multiplier for renewable energy. this proposal adopts that approach as well.

Finally, this comment adopts and renews the reasons provided when the proposal was first submitted without repeating those reasons here again.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal only provides another option for the simulation used for the performance path. Increasing available options allows for more designer control to avoid impacting construction costs.

Public Comment 2:

IECC®: R405.3 (IRC N1105.3), TABLE R405.3.1 (IRC N1105.3.1) (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: The energy use based on site energy or source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy estimate multipliers for energy sources shall be taken from Table R405.3.1, or from an *approved* local or regional source energy estimate multipliers.

**TABLE R405.3.1 (IRC N1105.3.1)
SOURCE ENERGY ESTIMATED MULTIPLIERS**

SOURCE ENERGY TYPE	ESTIMATED SOURCE MULTIPLIER^a
Electricity, Imported, General Grid	2.61
Electricity, Imported, Local or National RPS ^b	Greater of [2.61 x (1 - RPS%)] or 1.00
Electricity, Off-Site Delivered Renewable	1.00
On-Site Renewable Electricity, used by building or exported	1.00
On-Site Stored Renewable Electricity (used by building or exported)	1.00
Natural Gas, domestic, no flaring/venting	1.09
Natural Gas, domestic, with 20% flaring/venting	1.37
Natural gas, imported as LNG	1.25
Fuel Oil (1, 2, 4, 5, 6, Diesel, Kerosene), domestic	1.19
Fuel Oil, imported from overseas	1.45
Propane, Liquid Propane, domestic	1.15
Propane, Liquid Propane, domestic, with 20% flaring/venting	1.49
Steam, Non-Renewable	1.45
Steam, Renewable	1.00
Hot Water, Non-Renewable	1.35
Hot Water, Renewable	1.00
Chilled Water, Non-Renewable	1.04
Chilled Water, Renewable	1.00
Coal or Other, domestic	1.05

a. Values represent averages for the United States.

b. Renewable Portfolio Standard (RPS)

Commenter's Reason: This modification improves the proposal by doing the following:

-Providing more flexibility as it allows code officials to use regional or local estimates, instead of national estimates.

-Removing some of the more controversial estimates (even though they are technically accurate).

-Updating the outdated and incorrect estimates that have been in the code since 2009. Energy production has changed dramatically since then, and the current estimates are obsolete.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment makes simple clarifications in the proposed table. Clarifications to the code have no cost impact.

Public Comment# 1370

RE155-19

IECC: R405.3 (IRC N1105.3)

Proposed Change as Submitted

Proponents: Charles Foster, representing self (cfoster20187@yahoo.com)

2018 International Energy Conservation Code

Revise as follows:

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

~~**Exception:** The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~

Reason: There is only one metric that consumers are concerned with. That metric is cost. The IECC and its predecessor the model energy code traditionally relied on energy costs to demonstrate compliance. During the 2015 code cycle, this section added the current exception for the use of source energy as an alternative to cost.

Source energy is a relatively complex exercise used to estimate the approximate amount of raw energy consumed in the delivery of energy to ultimate customers. It is not a measurement nor a repeatable calculation across either geography or time.

Among its many limitations, source energy is particularly challenged when dealing with electricity as it treats electricity derived from renewables like solar and wind the same as electricity from an old coal fired generator.

The U.S. Department of Energy recognizes this absurdity – of treating wind the same as coal – and several years ago published a report on the topic. (SEE bibliography).

The overwhelming majority of jurisdictions using the IECC rely on cost.

There is no meaningful reason to keep the exception in the code and it should be removed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal imposes no additional compliance requirements and, therefore, neither increases nor decreases the cost of construction.

RE155-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: We need a proper source, but we are better off leaving as is then moving to a solution there is little agreement for. Suggested proponents, opponents join in developing a joint solution as public comment (Vote: 11-0).

Assembly Action:

None

RE155-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason:

There is only one metric that consumers are concerned with. That metric is cost.

The IECC and its predecessor the model energy code traditionally relied on energy costs to demonstrate compliance. During the 2009 code cycle, this section added the current exception for the use of source energy as an alternative to cost.

Source energy is a relatively complex exercise used to estimate the approximate amount of raw energy consumed in the delivery of energy to ultimate customers. It is not a measurement nor a repeatable calculation across either geography or time.

Among its many limitations, source energy is particularly challenged when dealing with electricity as it treats electricity derived from renewables like solar and wind the same as electricity from an old coal fired generator.

The U.S. Department of Energy recognizes this absurdity – of treating wind the same as coal – and several years ago published a report on the topic. (SEE bibliography).

The overwhelming majority of jurisdictions using the IECC rely on cost.

There is no meaningful reason to keep the exception in the code and it should be removed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal imposes no additional compliance requirements and, therefore, neither increases nor decreases the cost of construction.

Public Comment# 1994

RE156-19

IECC: R405.4 (IRC N1105.4) (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Add new text as follows:

R405.4 (IRC N1105.4) On-site renewable energy. *On-site renewable energy shall be considered as a reduction in energy use of the building.*

Reason: The IECC should integrate energy efficiency measures and renewable energy systems. Builders should get credit for what they do. As presented by the Building Technologies Office of the Department of Energy's 2018 National Energy Codes Conference, according to the U.S. Energy Information Administration's AEO 2018 report, typical Residential End Uses include Space heating at 24% and Space cooling at 11%, for a combined space heating/cooling at 35% of all Residential Energy End Uses. Water heating accounts for 13.5% of Residential Energy End Uses. These figures illustrate that we have done a very good job of reducing regulated loads, such that unregulated loads now represent greater than 50% of all Residential Energy End Uses. Renewable energy systems can offset not only the unregulated loads, but can also offset the reduced regulated loads.

Compliance measures and compliance paths that focus only on building envelope measures and discourage or penalize renewable energy systems -- or fail to make renewable energy systems attractive to builders as a compliance option -are focused on solving 35% of the problem. The IECC should encourage the use of energy efficiency plus renewable energy, to solve 100% of the problem.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Installation of an on-site photovoltaic system could increase or decrease the overall first cost of construction.

RE156-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Do not want to trade efficiency for solar, there is a place for renewables but they are not the same. The correct place to include would be in the ERI pathway (Vote: 7-4).

Assembly Action:

None

RE156-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests As Submitted

Commenter's Reason: This change specifies that on-site renewables count as a reduction in the residence's energy use. As we get to low and very low energy use in residences on-site renewables become more important. Almost all very low energy homes need renewables, often at levels well above 10 or 15%. For those going to "zero", efficiency can be perhaps 70% of the solution, but renewables are often needed to get about 30% of the energy reduction. Renewables need to count.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. Including equipment efficiency as an optional way to get the higher efficiency will often lower costs.

Public Comment 2:**Proponents:**

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests As Submitted

Commenter's Reason: The use of on-site renewable energy reduces a buildings demand on the energy grid and is operating off a renewable source and should be considered a reduction in the energy use. This terminology will help encourage the use of renewable energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal would not impact the cost of construction because it is not directly affecting how you construct a dwelling. The comment is simply acknowledging that on-site renewable energy shall be considered a reduction in energy use of the building because it is using less energy from the grid.

Public Comment# 1444

Public Comment 3:**Proponents:**

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: RE156 would be a huge efficiency rollback and should be disapproved as recommended by the Committee. RE156 is one of several proposals to add new trade-offs in the simulated performance compliance path for various measures such as appliances, renewables, lighting, heating/cooling equipment, and hot water equipment (see also RE152, RE175, RE176, RE179 and RE208). These proposals are collectively some of the biggest threats to energy efficiency proposed in this code cycle. These trade-offs do not even purport to increase efficiency, but instead would all result in less efficient buildings over the long-term that cost consumers more, use more energy and provide less comfort and sustainability. They would promote replacing long-lasting building efficiency measures, such as adequate insulation, efficient fenestration and reduced air and duct leakage, with measures that have much shorter useful lives, carry substantial free ridership and lack permanence. We fundamentally oppose simply creating more trade-offs that not only do not advance energy efficiency, but actually take a major step backward. We strongly support the IECC-Residential Committee's consistent recommendations to disapprove all of these proposals. It is important to note that similar proposals have been consistently disapproved by ICC Governmental Member Voting Representatives in the past three code cycles.

Turning to the specifics of RE156, this proposal is like RE152 in that RE156 is intended to allow 100% credit for on-site renewable energy as a trade-off to offset energy efficiency measures (unlike RE152, this proposal focuses exclusively on a trade-off for renewable generation). As discussed in our public comment on RE152, this concept is antithetical to maintaining the current level of energy efficiency in the IECC. The issue is not whether renewables are a good idea or whether they should be required by the code; the issue here is whether renewable energy should replace energy efficiency in a trade-off. Our answer (and the Committee's answer) is a clear "NO". Because the proposal adds a potentially unlimited source of trade-off credit to enable the builder to reduce efficiency measures without any increased stringency elsewhere in the code, RE156 serves only as a weakening amendment to the code and should be rejected.

Approval of RE156 would mean that a rooftop solar installation alone, for example, could be used to erase the efficiency improvements of the past decade or more (the amount of electric generation from a typical rooftop solar installation is a substantial percentage of the home's energy use). The proposal fails to take into account substantial free ridership, where solar would otherwise be installed anyway in addition to efficiency, often as a result of incentives or requirements of governmental entities or utilities. Moreover, allowing such a trade-off will result in increased energy use and cost and uncomfortable homes as efficiency is reduced based on trade-off credit from on-site renewable power generation.

We believe that while renewables are important and valuable additions to a building, they simply should not replace energy efficiency measures. Replacing energy efficiency with renewables means that renewable energy that could be used for other important purposes is simply being wasted in an inefficient building with no net gain. Such an approach is not consistent with sustainability or addressing our environmental challenges.

Aside from the efficiency rollbacks, RE156 also suffers from several problems of a technical nature:

- RE156 treats onsite renewable energy as “a reduction in energy use.” This is problematic because if on-site renewables are used as trade-offs against efficiency measures, the building will actually be using *more* energy with potentially higher peak demands (due to a less efficient building), even though during some parts of the day it will be supplied from on-site sources.
- The proposal does not provide any guidance as to how generation output will be calculated and credited in the performance path. Is the system required to be permanently a part of the real property (and owned), or will a leased system, that might be removed at any time, be sufficient?
- Should the code account for the likely shorter useful life of such a system, in comparison to other measures?

RE156 is a bad deal for consumers who might believe they are doing the right thing by installing on-site renewable energy, but whose homes will actually be uncomfortable energy hogs if these trade-offs are allowed. Rather than benefit from both the environmental benefits of renewable energy *and* reduced energy use, at best, homeowners would simply be trading one for the other.

RE156 risks rolling back the energy efficiency of the IECC with no limitation and it raises many technical questions that must be addressed. We strongly recommend disapproval of RE156.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1504

RE157-19

IECC: R405.4.2 (IRC N1105.4.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R405.4.2 (IRC N1105.4.2) Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* complies with Section R405.3. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a compliance report based on the as-built condition of the building shall be submitted to the *code official* before a certificate of occupancy is issued. ~~Batch sampling of buildings to determine energy code compliance shall only be allowed for stacked multiple family units.~~

Compliance reports shall include information in accordance with Sections R405.4.2.1 and R405.4.2.2. Where the *proposed design* of a building could be built on different sites where the cardinal orientation of the building on each site is different, compliance of the *proposed design* for the purposes of the application for the building permit shall be based on the worst-case orientation, worst-case configuration, worst-case *building* air leakage and worst- case duct leakage. Such worst-case parameters shall be used as inputs to the compliance software for energy analysis.

Reason: The purpose of this code change proposal is to remove confusing and incomplete language from the performance path regarding “batch sampling” of buildings. Section R405.4.2 contains orphan language that implies that batch sampling might be acceptable for stacked multiple family units, but there is no process or criteria for “batch sampling” defined anywhere in the IECC. Before any sort of sampling is allowed, a number of very important questions must be addressed, such as which parts of the building may be batch sampled, what sample size must be collected, what happens in the event of a failure, etc. Although some common voluntary programs permit sampling for certain specified measures, the IECC does not currently allow this practice and should not until these important questions are addressed. Moreover, we are concerned that batch sampling would fail to ensure that every home meets the code, since presumably only some homes would be included in the sampling.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal cleans up excess language that refers to sampling practices that do not currently exist in the IECC.

RE157-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This language must be retained to allow building officials to accept sampling (Vote: 7-4).

Assembly Action:

None

RE157-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it eliminates language that is unnecessary and that could lead to confusion in enforcement. Moreover, elimination of this provision would make it clear that sampling is not permitted for purposes of code compliance. As discussed in more detail in our public comment on RE10, we believe that sampling is inappropriate for a mandatory minimum code, because it does not guarantee that every new building complies with the code.

In our view, the IECC currently does not specifically allow sampling for any code requirements. The language in R405.4.2 referencing "batch sampling of buildings" is a limit on sampling, not an authorization for sampling (and it is included in a section related to compliance reports for documentation of performance path compliance). Further, it is too vague and lacks any sort of effective guidelines for builders or code enforcement personnel. There are no other references to sampling in the residential energy code provisions. Unless and until a more specific sampling protocol (which we would oppose) is adopted into the code, this language should be eliminated.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As stated in the original proposal, this cleans up excess language that refers to sampling practices that do not currently exist in the IECC.

Public Comment# 1486

RE161-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Vertical fenestration other than opaque doors	<p>Vertical Fenestration Total area^h =</p> <p>(a) The proposed <u>vertical fenestration glazing area (AVF)</u>, where the proposed <u>total fenestration glazing area (AF)</u> is less than 15 percent of the conditioned floor area (<u>CFA</u>)</p> <p>(b) 15 percent of the conditioned floor area The <u>adjusted vertical fenestration area (AVF_{adj})</u>, where the <u>AF proposed glazing area</u> is 15 percent or more of the <u>conditioned floor area CFA</u>. $AVF_{adj} = AVF \times (0.15 \times CFA/AF)$</p>	As proposed
Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed	
U-factor: as specified for Fenestration in Table R402.1.4.	As proposed	
SHGC: as specified for Glazed Fenestration in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed	
Interior shade fraction: 0.92-(0.21 \tilde{A} □ SHGC for the standard reference design).	Interior shade fraction: 0.92-(0.21 \tilde{A} □ SHGC as proposed)	
External shading: none.	As proposed	
Skylights	<p>None Skylight area^h =</p> <p>(a) The proposed <u>skylight area (ASKY)</u>, where the proposed <u>total fenestration area (AF)</u> is less than 15 percent of the conditioned floor area (<u>CFA</u>)</p> <p>(b) The <u>adjusted skylight area (ASKY_{adj})</u>, where the AF is 15 percent or more of the CFA. $ASKY_{adj} = ASKY \times (0.15 \times CFA/AF)$</p>	As proposed
Orientation: as proposed	As proposed	

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
<u>U-factor: as specified for Skylights in Table R402.1.2</u>	<u>As proposed</u>	
<u>SHGC: as specified for Glazed Fenestration and footnote (b) in Table R402.1.2, except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.</u>	<u>As proposed</u>	
<u>For the area of proposed skylights equipped and rated with factory-installed interior shades: the interior shade fraction is 0.92 - (0.21 x SHGC) [SHGC as above for the standard reference design]</u>	<u>As proposed, with shades assumed closed 50% of the daylight hours</u>	
<u>External shading: none</u>	<u>As proposed</u>	

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

- a. Where required by the *code official*, testing shall be conducted by an *approved party*. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals*, page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.
- c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the

predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

h. Light-transmitting fenestration area includes the area of sash, curbing or other framing elements that are part of the conditioned space enclosure, including light-transmitting assemblies in the walls bounding conditioned basements. For doors where the light-transmitting opening is less than 50 percent of the door area, only the light-transmitting area is included.

For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing fenestration area:

$$AF = A_s \times FA \times F$$

where:

AF = ~~Total glazing~~ Proposed total fenestration area.

A_s = Standard reference design total glazing fenestration area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 \times below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater;

and where: Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

~~AF , A_s and CFA~~ are in the same units.

Reason: The IECC residential simulated energy performance analysis standard reference design specification table has historically included skylight area in the “Glazing” row, as reflected in the 2012 IECC:

**TABLE R405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing ²	Total area ^b – (a) The proposed glazing area; where proposed glazing area is less than 15% of the conditioned floor area. (b) 15% of the conditioned floor area; where the proposed glazing area is 15% or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: from Table R402.1.3	As proposed
	SHGC: From Table R402.1.1 except that for climates with no requirement (NR) SHGC – 0.40 shall be used.	As proposed 0.92-(0.21 × SHGC as proposed)
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design) External shading: none	As proposed

- ...
- a. Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than 50 percent of the door area, the glazing area is the sunlight transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.
 - b. For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine glazing area:
 $AF = A_s \times FA \times F$
 where:
 AF = Total glazing area.
 A_s = Standard reference design total glazing area.
 FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).
- ...

Footnote (a) clearly refers to “the area of ... curbing ...” in the definition of “Glazing”, which is only germane to skylights on a roof. The commentary versions of the 2012 and prior editions reinforce this intent to cover skylight area in the glazing row for the reference design.

The approval of RE173-13 upset the applegart for skylights in the 2015 IECC. The proponent later acknowledged at 2018 IECC code hearings that it was not intentional, but the two major elements of that change took away the only place for skylights to be included in the reference design:

- “Glazing” was changed to “Vertical fenestration other than opaque doors”
- Footnote (a) was inexplicably deleted, rather than redefine fenestration area calculation rules.

Our proposed changes to Table R405.5.2(1) reinstate the allowance to include skylight area in the Standard Reference Design as part of the Total Fenestration Area when they are part of the proposed design, by adding the following:

1. Provisions for skylight area, U-factor and shading that mirror the Vertical Fenestration provisions, wherever practical.
2. Provisions for skylight SHGC that mirror those for Vertical Fenestration, with the addition of a reference to Footnote (b) of Table R402.1.2 specific to skylight SHGC.
3. Provisions for skylight orientation based upon “As Proposed”. Typically, skylight installation in residential construction is not able to be equally distributed to all four cardinal compass orientations, as assumed for vertical fenestration under the Simulated Performance Alternative provisions.
4. Suitable interior shading provisions that are used when any of the proposed skylights are rated products that include integral interior shading.

This proposal also includes the following coordinating changes:

1. In footnote (h), reference to “glazing area” is replaced by “fenestration area”, while restoring needed clarifying language from old footnote (a) defining what is included in calculating the area of various fenestration products regardless of slope or position on the envelope.
2. Provisions are added to reduce the vertical fenestration area and skylight area proportionally for the Standard Reference Design, whenever any skylight area is proposed and total fenestration area equals or exceeds 15% of conditioned floor area.

Bibliography: 2012 IECC, Table R405.5.2(1)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
 The code change proposal will not increase the cost of construction but rather reinstates language that was unintentionally removed.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Appropriate to reintroduce unique features of skylights (Vote: 7-4).

Assembly Action:

None

RE161-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing IECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it would reduce the efficiency of the performance path for homes that incorporate skylights, and would incorporate an entirely new, complicated and confusing calculation into the performance path that is completely unnecessary. A similar proposal was disapproved in the 2018 Code Development Cycle, and this one should be disapproved as well for several reasons:

- **RE161 reduces efficiency.** For several editions, the IECC performance path has included a glazing/vertical fenestration area assumption that adjusts the baseline depending on the proposed design. For below-average glazing area homes (<15%), the reference design glazing area is reduced to match that of the proposed design, eliminating unnecessary trade-off credit for homes with low glazing area. RE161 would take the difference between 15% and the proposed glazing area and repurpose it as skylight area. This is a big reduction in efficiency in such cases, since it essentially permits skylights (roughly equivalent to R-2) to replace ceiling insulation that would be required to achieve R-38 or R-49.
- **RE161 is unnecessary.** The prescriptive compliance path already allows unlimited skylight area, with no penalty whatsoever. Likewise, the Total UA path, which compares the proposed design to a geometrically equivalent standard reference design (i.e. same skylight area), also allows unlimited skylight area with no penalty. There is no need to establish a special approach for skylights in the performance path.
- **RE161 is technically flawed.** The proposal introduces a trade-off credit for interior shades for skylights and includes an arbitrary assumption in the proposed design that shades are “closed 50% of the daylight hours.” The IECC has historically not allowed trade-offs related to interior shading; this is a step in the wrong direction. There is no technical foundation for such an assumption, and it does not match the shading assumption for other types of fenestration in the performance path. In short, this provides additional, unwarranted trade-off credit for skylights.
- **RE161’s proposed changes do not “reinstate” an allowance for skylight area in the standard reference design as suggested by the proponent and the Committee.** The proponent’s reason includes the statement: “Our proposed changes to Table R405.5.2(1) reinstate the allowance to include skylight area in the Standard Reference Design ...” The brief Committee Reason on RE161-19 also reflects this concept: “Appropriate to reintroduce unique features of skylights.” To be clear: *The language in RE161-19 is not re-introducing anything.* It is entirely new language that has never been part of the IECC. The proponent’s Reason Statement claims that the IECC performance path historically “included skylight area in the ‘Glazing’ row.” This appears to be incorrect. Going back to at least the 2006 IECC, skylights have never been included in the glazing row of the standard reference design. There has always been a separate row for skylights, and the assumed area has always been “none.” Going back even farther to the first version of the IECC (1998), prior to the current table describing the elements of the standard reference design, the code simply stated: “Skylights ... shall not be included in the Standard design” (Section 402.1.1, Exception 4).

We do not think it is unreasonable to leave the assumption for skylights at “none” in the performance path, just as it has been for many IECC editions. Skylights are not a standard feature in most homes, and it does not make sense to create a trade-off credit for them at the expense of energy efficiency. This does not prohibit skylights from being installed in the performance path – it just requires builders to account for the reduced efficiency and avoids an unnecessary free trade-off credit. Again, builders who find this too restrictive can simply use the prescriptive or Total UA paths to specify an unlimited amount of skylight area with no penalty. But we do not see any good reason to introduce this complicated reduction in

efficiency in the IECC's performance path.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1488

RE165-19

IECC: TABLE R405.5.2(2) [IRC N1105.5.2(2)]

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R405.5.2(2) [IRC N1105.5.2(2)]
 DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS^a**

Portions of table not shown remain unchanged.

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS ^b
Distribution system components located in unconditioned space	—	0.95
Untested distribution systems entirely located in conditioned space ^c	0.88	1
<u>Proposed "reduced leakage" when the installed air distribution system is located entirely within the continuous air barrier assembly and building thermal envelope's defined conditioned space as verified through inspection before drywall has been installed^e</u>	0.96	—
"Ductless" "Ductless" systems ^d	1	—

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m², 1 pound per square inch = 6895 Pa, 1 inch water gauge = 1250 Pa.

- a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.
- b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.
- c. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.
- d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer's air-handler enclosure.
- e. For homes with thermal distribution systems documented through visual verification at a rough stage of construction before drywall has been installed to be entirely within the continuous air barrier assembly and building thermal envelope of conditioned space, including all ducts and the manufacturer's air handler enclosure, a DSE of 0.96 shall be applied to the Proposed Design without the requirement to conduct duct leakage testing. Alternatively, Total leakage of not greater than 4 cfm per 100 ft² of conditioned floor area at a pressure difference of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors.

Reason: The energy penalty or loss of duct leakage is different for duct systems that are located inside or outside of the buildings continuous air barrier assembly. The 2006 IECC recognized this in the IECC table titled, "DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS" that accompanies the proposed and reference home table for the Simulated Performance Alternative path. At some point this was removed, but since the energy code only requires testing for Total duct leakage it makes sense to add it back in. If the entirety of the duct system including the air handler cabinet is confirmed to be located inside conditioned space as defined by the continuous air barrier and thermal envelope assemblies, then the likelihood of the system leaking to the outdoors is little. Therefore, the energy loss of duct leakage to outside would also be little. If testing is not performed for duct leakage to outside a small penalty should be assessed which this proposal provided. If, alternatively, a total duct leakage test is performed then the total duct leakage test results can be used in the modeling for leakage to outside which this proposal also allows as long as the total duct leakage number is not greater than 4 CFM per 100 ft² of conditioned floor area. This proposal, although allowing verified HVAC duct systems not to be tested for duct leakage to outdoors, does assess a DSE of 0.96 which equates to a 4% energy loss for the system. Thus, if needed for compliance or to allow designed tradeoffs to be calculated in the software, duct leakage could be tested to demonstrate a reduced leakage level below this rate.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. In most cases this proposal would lower the cost of 3rd party compliance with the IECC as a single total duct leakage test could be used to document location and leakage of the duct system allowing for no testing to occur to quantify duct leakage to the outdoors.

RE165-19

Public Hearing Results

Committee Action:

As Modified

**Committee Modification:
 2018 International Energy Conservation Code**

TABLE R405.5.2(2) [IRC N1105.5.2(2)]

DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS^a

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS ^b
Distribution system components located in unconditioned space	—	0.95
Untested <u>and Unverified</u> distribution systems entirely located in conditioned space ^c	0.88	1
Untested and Verified distribution systems entirely located in conditioned space. <u>Proposed</u> “Reduced leakage” when the installed air distribution system <u>has been verified to be</u> is located entirely within <u>conditioned space</u> . the continuous air barrier assembly and building thermal envelope’s defined conditioned space as verified through inspection before drywall has been installed^d	0.96	—
“Ductless” “Ductless” systems ^d	1	—

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m², 1 pound per square inch = 6895 Pa, 1 inch water gauge = 1250 Pa.

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

c. Default distribution efficiency for homes where the thermal distribution system is not visible at the time of testing and has NOT been visually documented at a rough stage of construction before drywall has been installed to be entirely in conditioned space. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer’s air-handler enclosure.

e. Default distribution efficiency for compliance with Sections R405 and R406 homes with thermal distribution systems documented through visual verification at a rough stage of construction before drywall has been installed to be entirely within the continuous air barrier assembly and building thermal envelope of conditioned space, including all ducts and the manufacturer’s air handler enclosure, a DSE of 0.96 shall be applied to the Proposed Design without the requirement to conduct duct leakage testing. Alternatively, Total leakage of not greater than 4 cfm per 100 ft² of conditioned floor area at a pressure difference of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors.

Committee Reason: This provides more clarify and aligns with Standard 380. The modification clarifies language that was left out of the original proposal (Vote AM 10-1).

Assembly Action:

None

RE165-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EEC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter’s Reason: This proposal should be disapproved because it reduces efficiency by awarding additional credit to untested but verified systems located entirely in conditioned space (thereby offsetting the need for other efficiency measures). The proposal also discourages testing by giving the system additional credit without testing. Further, the proposal is also inconsistent with the Committee’s recommendation to approve RE112, which will require duct testing in all new homes, including those with all ducts inside conditioned space. In short, RE165 awards far too much credit for distribution system efficiency for systems that have not been tested.

We believe that installing all supply and return ducts inside conditioned space is good design; however, information collected through field studies

in multiple states shows that even where all ducts are located inside conditioned space, duct systems can still be extremely inefficient. As we noted in the reason for RE112, DOE field studies in Kentucky and Pennsylvania showed that homes with all ducts located inside conditioned space still had duct leakage in the range of 6.26 to 40.36 cfm (Kentucky) and 12.6 to a whopping 77.1 cfm (Pennsylvania). <https://www.energycodes.gov/compliance/energy-code-field-studies>.

Results of DOE Field Study Data Collection on Duct Tightness				
	Ducts in Conditioned Space (Exempt from Test)		Ducts Outside Conditioned Space (Testing Required)	
	Kentucky	# Samples	24	# Samples
Max Test Result		40.36	Max Test Result	18.90
Min Test Result		6.26	Min Test Result	3.10
Avg Test Result		18.46	Avg Test Result	9.71
Pennsylvania	# Samples	18	# Samples	52
	Max Test Result	77.10	Max Test Result	69.00
	Min Test Result	12.60	Min Test Result	2.44
	Avg Test Result	30.95	Avg Test Result	17.95

RE165 is unnecessary if RE112 is approved, since every new home will be required to be tested for duct tightness, and the actual result of the duct test will be included in the performance calculation. However, even if duct testing were not required universally, we still think it is not a reasonable assumption that homes with all ducts and air handlers located inside conditioned space will achieve a system efficiency of 0.96.

Bibliography: <https://www.energycodes.gov/compliance/energy-code-field-studies>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1492

RE166-19

IECC: TABLE R405.5.2(1), [IRC N1105.5.2(1)]

Proposed Change as Submitted

Proponents: Gary Klein, representing self (gsmklein@comcast.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R405.5.2(1), [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water heating ^{d, e, f, g}	<p>The efficiency shall be selected based on a water heater with the same first hour rating and draw pattern as the As proposed water heater.</p> <p>Use: same as proposed design.</p>	<p>As proposed</p> <p>Use, in units of gal/day = 30 + (10 × N_{br})</p> <p>where:</p> <p>N_{br} = number of bedrooms.</p>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

- a. Where required by the *code official*, testing shall be conducted by an *approved party*. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals*, page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.
- c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
- h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

$$AF = A_s \times FA \times F$$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

L and CFA are in the same units.

Reason: The method of test for water heater efficiency was updated in 10 CFR §430.32 (2018). The proposed changes to the service water heating row in the performance table reflect these changes.

The two deleted footnotes referred to in this row do not appear to be related to water heating.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The updates to the table are the same in both the standard reference and the proposed columns. No new requirements are imposed on construction practices, hence no changes to the cost of construction are expected.

RE166-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This adds language to clarify how water heaters are modeled and adds the 1-hour rating specification (Vote: 11-0).

Assembly Action:

None

RE166-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is unnecessary, does not improve the code, and could create confusion. The current standard reference design simply states that the service water heating shall be "as proposed." It is clear that this language requires use of exactly the same water heater both in the standard reference design and proposed design and ensures that there is no trade-off for equipment efficiency. The modification to the language, while more specific, is unnecessary, since "as proposed" would already require the same first hour rating and draw pattern. However, language that limits "as proposed" by these factors could create confusion as to other aspects of the equipment. The simpler approach currently in the code of using "as proposed" is clearer and better. It is also important that any changes to equipment specifications not be viewed as reinstating some form of equipment trade-off. While the proposed change should not be interpreted to reinstate the trade-off, it is better to stick with the status quo and avoid any confusion or question on this matter.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1493

RE171-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	<p>Duct insulation: in accordance with Section R403.3.1.</p> <p>A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies. for all systems other than tested duct systems-</p> <p>Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency. (DSE) shall be 1.</p> <p>For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).</p>	<p>Duct insulation: as proposed.</p> <p>As tested or, where not tested, as specified in Table R405.5.2(2)</p>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

Reason: With the current language in the Standard Reference Design for Thermal Distribution Systems, there is an inconsistent baseline. Depending on the configuration of the mechanical systems and testing, there could be at least 5 different Standard Reference Designs for a single house:

- Ducts completely inside conditioned space and tested
- Ducts completely inside conditioned space and not tested
- Ducts outside conditioned space
- Hydronic systems
- Ductless systems

This becomes really problematic when looking at a home with ducts in the attic (which hypothetically barely passes code in the performance path) and comparing it to the same home with ducts moved into conditioned space- which will typically not pass; this sends the wrong message. There is also no code related benefit for a hydronic system which has a higher distribution efficiency than a ducted system.

The proposed solution moves back to the format that RESNET uses and is nearly identical to the language in the 2006 IECC, but with a higher DSE (0.88 vs. 0.80). The modification results in a single Standard Reference Design.

A consistent baseline is essential to provide the proper credit and send the right message when designing thermal distribution systems. Systems inside conditioned space (0.88) should be encouraged over ducts in attics (0.80), credit should be given for a hydronic system (1.0) over a ducted system (0.88). None of this is true with the current language.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not effect the cost of construction.

RE171-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Although the committee applauds the intent to establish a baseline, there is disagreement on necessary the modification, and encourage a public comment (Vote: 6-5).

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	<p>Duct insulation: in accordance with Section R403.3.1. A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</p> <p>The leakage rate shall be 4 cfm (113.3 L/min) per ft² (9.29 m²) of conditioned floor area at a pressure differential of 0.1 inch w.g. (25 Pa).</p>	<p>Duct insulation: as proposed. As tested or, where not tested, as specified in Table R405.5.2(2)</p>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

Commenter's Reason: This modification is responding to the committee request.

The baseline is being modified to create a consistent Thermal Distribution System Standard Reference Design. The baseline assumption is that the duct system leaks at the rate of 4 CFM/100ft². This is consistent with only one of the current potential baselines. This change will properly incentivize good thermal distribution system design- so the more energy saved by the distribution system, the more credit is give toward code compliance.

Currently the lack of a consistent baseline is problematic when looking at a home with ducts in the attic (which hypothetically barely passes code in the performance path) and comparing it to the same home with ducts moved into conditioned space- which will typically not pass; this sends the wrong message. There is also no code related benefit for a hydronic system which has a higher distribution efficiency than a ducted system.

A consistent baseline is essential to provide the proper credit and send the right message when designing thermal distribution systems.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This Public Comment provides builders and designers the opportunity to cost-effectively design thermal distribution systems and provide proper credit toward code compliance.

Public Comment# 2019

RE176-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)], DOE Chapter 6

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems ^{d, e}	<p>For other than electric heating without a heat pump: as proposed. Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section G403 of the IECC—Commercial Provisions.</p> <p>Capacity: sized in accordance with Section R403.7.</p> <p><u>Fuel Type/ Capacity: Same as proposed design</u></p> <p><u>Product class: As proposed</u></p> <p><u>Efficiencies:</u></p> <p><u>Heat pump: Complying with Subpart C of 10 CFR 430.32 (2021)</u></p> <p><u>Furnaces: Complying with Subpart C of 10 CFR 430.32 (2021)</u></p> <p><u>Boilers: Complying with Subpart C of 10 CFR 430.32 (2021)</u></p>	<p>As proposed</p> <p><u>As Proposed</u></p> <p><u>As Proposed</u></p> <p><u>As Proposed</u></p> <p><u>As Proposed</u></p> <p><u>As Proposed</u></p>
Cooling systems ^{d, f}	<p>As proposed. Capacity: sized in accordance with Section R403.7.</p> <p><u>Fuel Type/ Capacity: Same as proposed design</u></p> <p><u>Efficiencies: Complying with Subpart C of 10 CFR 430.32 (2021)</u></p>	<p>As proposed</p> <p><u>As Proposed</u></p> <p><u>As Proposed</u></p>
Service water heating ^{d, e, f, g}	<p>As proposed. Use: same as proposed design.</p> <p><u>Fuel Type: Same as proposed design Subpart C of 10 CFR 430.32 (2021)</u></p> <p><u>Efficiencies: Uniform Energy Factor</u></p> <p><u>Use: gal/day = 30 + 10 x Nbr</u></p> <p><u>Tank temperature: 120 °F</u></p>	<p>As proposed</p> <p><u>Use, in units of gal/day = 30 + (10 x N_{br})</u></p> <p><u>where:</u></p> <p><u>N_{br} = number of bedrooms.</u></p> <p><u>As Proposed</u></p> <p><u>As Proposed</u></p> <p><u>Same as standard reference</u></p> <p><u>Same of standard reference</u></p>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

~~g. For a proposed design with a nonstorage type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design. assumed for the standard reference design. The minimum uniform energy factor shall be selected based on the Medium draw pattern found in Subpart C of 10 CFR 430.32 (2021). This water heater shall be used for the proposed water heater in the case of a proposed design without a proposed water heater.~~

Add new standard(s) as follows:

DOE U.S. Department of Energy 10 CFR, Part 430: Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances.

10 CFR, Part 431: Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards; Final Rules

Reason: Equipment efficiency is a key part of home energy efficiency. This proposal restores equipment efficiency to the performance calculation. This proposal also corrects a long-standing error in the code, that of citing “prevailing federal minimum efficiency”.

The code’s use of “prevailing federal minimum efficiency” is inappropriate and may hamper adoption. Yes, this language has been used for some time and is currently in three existing table footnotes, footnotes “e”, “f” and “g”. However, “prevailing” creates a problem. When states, counties and cities adopt laws, they are obligated to make the exact content of the law available to the public. When the ‘prevailing’ federal minimum efficiency changes; the jurisdiction’s code also changes automatically. Changing the “prevailing” standard without any jurisdictional process means another body, which is not the legislative body of the jurisdiction, changes the laws within the jurisdiction without any public hearing or vote by the local legislative body. This is called an illegal delegation of legislative authority. This is why I-code referenced standards always come with a date/edition (see the referenced standard chapter). The I-codes don’t reference any old edition of a standard, they reference a specific edition of that standard.

The other problem with simply saying ‘prevailing federal minimum efficiency’ is that it doesn’t tell the designer or the code official where to find those values. The solution is to cite the specific Federal law and date, just as is done with any standard referenced in the I-codes. Yes – this does lock in the efficiency standard used for 3 years. But that is what we do for every other standard.

Equipment efficiency is a key part of home energy efficiency. More efficient equipment saves more energy. Significant energy savings is available for every type of equipment efficiency. A high-efficiency 95 AFUE furnace saves energy. A high-efficiency 19 SEER air conditioner saves energy. Ground source heat pumps save considerable energy. Solar water heating saves energy. Homes that use more efficient equipment should get credit for choosing more efficient equipment. Equipment efficiency was a part of the residential IECC performance calculation in 2006 and prior. Equipment efficiency is part of the commercial IECC performance calculation, ASHRAE 90.1 and 90.2, to name a few.

Some argue that longer-life measures should not be traded for shorter-life measures. For example, don’t trade lower wall insulation for higher equipment efficiency. However the ERI allows one to trade higher-efficiency refrigerators, higher-efficiency clothes washers and higher-efficiency dishwashers for lower wall insulation. Clothes washers in particular are often moved with the owner when a house is sold. The lifetime of windows is less than insulation, should we allow better windows to be traded for lower wall insulation? I’d argue to keep all tradeoffs. However, if one argues to keep equipment efficiency tradeoffs out of Section R405 performance trades, then to be consistent one should also argue to keep equipment efficiency, refrigerators, clothes washers and dishwashers out of the tradeoffs for insulation in the ERI.

Why was equipment efficiency taken out of after the 2006 residential IECC? In the proponent’s opinion one reason was to protect the market for some types of products that thought equipment efficiency might compete and reduce their market share. For instance, some might use high efficiency equipment instead of higher levels of insulation. The goal of the code should be to deliver energy efficiency, not to protect products.

Moving to even higher levels of energy efficiency in the code will require restoring flexibility, part of which is equipment efficiency. If builders get credit for what they do, be it equipment efficiency, solar, or whatever, then this proponent is comfortable asking them to achieve higher levels of efficiency, even increasing requirements through code. However, without flexibility, then builders need more exceptions and lesser requirements to make up for the flexibility they are denied by code. Without restoring flexibility, additional energy efficiency in code is much more difficult to achieve.

Cost Impact: The code change proposal will decrease the cost of construction

Allowing credit for high efficiency equipment will encourage energy efficiency and promote lower cost ways to get to energy efficient homes.

Staff Analysis: A review of the standard proposed for inclusion in the code, 10 CFR 430.32 (2021), with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RE176-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The addition of tradeoffs in this compliance path would result in decreased envelopes and increased energy use. Tradeoffs are better handled in the ERI approach (Vote: 6-5).

Assembly Action:

None

RE176-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests As Submitted

Commenter's Reason: High efficiency equipment is an important part of high efficiency residences. Acting as if equipment efficiency has no impact is silly. As we go towards lower energy use, perhaps even "zero", equipment efficiency will be a big part of very high efficiency. The ERI path commonly includes and credits high efficiency equipment. Why should high efficiency equipment be in one path and not another?

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. High efficiency equipment is usually part of the least cost way to get to high efficiency.

Public Comment# 1940

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: RE176 would be a huge efficiency rollback and should be disapproved as recommended by the Committee. RE176 is one of several proposals to add new trade-offs in the simulated performance compliance path for various measures such as appliances, renewables, lighting, heating/cooling equipment, and hot water equipment (see also RE152, RE156, RE175, RE179 and RE208). These proposals are collectively some of the biggest threats to energy efficiency proposed in this code cycle. These trade-offs do not even purport to increase efficiency, but instead would all result in less efficient buildings over the long-term that cost consumers more, use more energy and provide less comfort and sustainability. They would promote replacing long-lasting building efficiency measures, such as adequate insulation, efficient fenestration and reduced air and duct leakage, with measures that have much shorter useful lives, carry substantial free ridership and lack permanence. We fundamentally oppose simply creating more trade-offs that not only do not advance energy efficiency, but actually take a major step backward. We strongly support the IECC-Residential Committee's consistent recommendations to disapprove all of these proposals. It is important to note that similar proposals have been consistently disapproved by ICC Governmental Voting Member Representatives in the past three code cycles.

Turning to the specifics of RE176, the primary purpose of this proposal is to reinstitute heating, cooling and hot water equipment trade-offs in the simulated performance path. These trade-offs were correctly eliminated in the 2009 version of the code and have been consistently rejected in

every code cycle since then. Some of the specific issues and problems with equipment trade-offs are outlined below:

- **Equipment trade-offs drastically reduce energy efficiency.** ICF International, a nationally recognized energy consulting firm, conducted a detailed analysis of the negative impacts of a similar proposal to reinstate equipment tradeoffs during the 2015 code cycle (September 2013). Specifically, the study found that introducing equipment trade-offs into the performance path would have a huge negative impact on energy efficiency – a combined national average estimated impact of between 11% and 22% reduction in efficiency depending on the climate zones and trade-offs employed. For example, installing a 90 AFUE gas furnace would reduce energy efficiency under the code by 6% to 9% depending on the climate zone (note that furnaces considerably more efficient than this are commonly installed, which would create larger trade-off credit). Similarly, installing an instantaneous (tankless) water heater alone would yield 9% trade-off "credit," which means the rest of the home could be built 9% less efficient, on average, just for installing a better water heater. Massive trade-offs (efficiency reductions) of other important energy efficiency measures (insulation, windows, air and duct leakage) would be permitted if this approach were reinstated. This study can be found at: http://energyefficientcodes.com/wpcontent/uploads/2013/08/2013-9-23-FIN-Review-Analysis-of-Equipment-Trade-offs-in-Residential-IECC.FIN_.pdf

- **Equipment trade-offs are not "energy neutral" as claimed by proponents.** In fact, as noted in the ICF study, equipment trade-offs result in huge losses in energy efficiency – up to a reduction of 20% or more – essentially wiping out much of the progress made in advancing energy efficiency in the IECC over the last couple of decades. In addition to the discussion above, there are several reasons why trade-offs for heating, cooling, and water heating efficiency are not "neutral" and are in fact net reductions in energy efficiency – and thus would significantly weaken those homes that comply under the performance path:
 - **Federal preemption** – Equipment trade-offs are fundamentally a problem because unlike other parts of a building (such as building envelope components) that can be directly regulated by state and local governments (and the IECC), federal law prohibits states and cities from setting reasonable energy efficiency requirements for this equipment. Only the federal government has authority to set the minimum efficiency requirements for heating, cooling, and water heating equipment, and these federal standards are often outdated and lag far behind the efficiency of commonly-installed equipment.
 - **Free ridership** – Because federal minimum efficiency requirements are so far behind commonly-installed equipment, using these values as a trade-off comparative baseline as proposed in RE176 would create an artificial trade-off "gap," permitting builders to trade away the efficiency of the building thermal envelope for more efficient equipment that they would have installed anyway. This is a "free ridership" cost reduction for the builder, but it results in much higher energy costs being imposed on the homeowner.

State-level field studies have consistently shown that equipment installed in new homes is typically far more efficient than the federal minimum efficiencies (without any trade-off credit). For example:

- New York recently completed a residential baseline study that indicated 94% of new homes included a furnace with an AFUE of 90 or greater (despite a federal minimum of 80 AFUE, roughly 10% less efficient) and 71% of new homes with an AFUE of 94 or better. See <https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/residential-baseline-study/Vol-3-HVACRes-Baseline.pdf>
- Likewise, in Pennsylvania, over 98% of homes studied had condensing furnaces with an AFUE above 90 and over 96% above 92 AFUE. See <https://www.energycodes.gov/compliance/energy-code-field-studies>

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Allowing trade-off credit for above-minimum efficiency equipment in these situations would simply be a give-away to builders and a major blow to homeowners, as well as to sustainability and the environment.

- **Equipment trade-offs trade-away long-term energy efficiency for short-term builder cost reduction.** Aside from free ridership issues, another problem with equipment trade-offs is the likelihood that builders will trade away the long-term benefits (to homeowners) of features such as an efficient thermal envelope, in favor of short-term cost cutting in the form of more efficient equipment, which will be replaced several times over the lifetime of the home. For example, if a trade-off is permitted for water heater efficiency, an instantaneous natural gas water heater would allow the builder to reduce the efficiency of the rest of the home by an average of 9%. The remaining home will be 9% less efficient for its entire useful lifetime. As the water heater is replaced every 10-15 years, the envelope of that home will continue to underperform by 9%. By contrast, under the current code, no trade-off credit is awarded for the instantaneous water heater, which means the rest of the home will be built to meet the code. As the water heater is swapped out in future years, the current code home will outperform the trade-off home by 9%.
- **It is unnecessary to address efficient equipment in the performance path; the issues are already much better addressed in the ERI compliance path.** As the Committee pointed out in its reasons supporting its recommendation to disapprove RE176, the 2018 IECC does address equipment efficiency, but only within the Energy Rating Index. This is because the ERI Index target is set at a level low enough to recapture most of the free-ridership losses. The simulated performance path does not have the built-in protections of the ERI path.
- **Equipment trade-offs have been eliminated in the vast majority of states consistent with state and federal law and policy.** Most states have adopted the IECC and completely eliminated equipment trade-offs, turning the page on this efficiency loophole with no negative impact. Federal law has endorsed adoption of the 2009 IECC, which eliminated equipment trade-offs, as part of ARRA. Similarly, the U.S. Department of Housing and Urban Development and the U.S. Department of Agriculture have adopted energy conservation standards that apply to federally-insured mortgages. In order to qualify for one of these federally-insured loans (such as FHA), new homes must meet or exceed the requirements of the 2009 IECC.

Most states have been enforcing building energy codes with no equipment trade-offs for a number of years now, and with great success. There is no evidence that eliminating trade-offs has affected installation of high-efficiency furnaces, air conditioners, or water heaters. In fact, the market penetration of efficient equipment continues to grow. Reinstating these trade-offs, *after more than a decade without them*, would move energy efficiency for the rest of the home sharply backward for no good reason, and would create a host of new problems.

Bibliography: http://energyefficientcodes.com/wpcontent/uploads/2013/08/2013-9-23-FIN-Review-Analysis-of-Equipment-Trade-offs-in-Residential-IECC.FIN_.pdf
<https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/residential-baseline-study/Vol-3-HVACRes-Baseline.pdf>

<https://www.energycodes.gov/compliance/energy-code-field-studies>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1508

RE178-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)], TABLE R403.6.1 (IRC N1103.6.1)

Proposed Change as Submitted

Proponents: Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	<p>The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 1 and 2: 5 air changes per hour. Climate Zones 3 through 8: 3 air changes per hour.</p> <p>The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$</p> <p>where:</p> <p>CFA = conditioned floor area, ft².</p> <p>N_{br} = number of bedrooms.</p> <p><u>The mechanical ventilation system type shall be the same as in the proposed design.</u> Energy recovery shall not be assumed for mechanical ventilation.</p>	<p>The measured air exchange rate.^a</p> <p>The mechanical ventilation rate^b shall be in addition to the air leakage rate and shall be as proposed.</p>
Mechanical ventilation	<p>Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal:</p> $(1/e_f) \times [0.0876 \times CFA + 65.7 \times (N_{br} + 1)]$ <p>where:</p> <p>e_f = the minimum exhaust fan efficacy, as specified in Table R403.6.1, corresponding to <u>the system type at</u> a flow rate of $0.01 \times CFA + 7.5 \times (N_{br} + 1)$</p> <p>CFA = conditioned floor area, ft².</p> <p>N_{br} = number of bedrooms.</p>	As proposed

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

- a. Where required by the *code official*, testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals*, page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.
- c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
- h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

$$AF = A_g \times FA \times F$$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

L and CFA are in the same units.

**TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY^a**

FAN LOCATION SYSTEM TYPE	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)	AIR FLOW RATE MAXIMUM(CFM)
HRV, or ERV, or balanced	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line supply or exhaust fan	Any	2.8 cfm/watt	Any
Other exhaust fan Bathroom, utility room	$4\theta < 90$	1.4 cfm/watt	< 90
Bathroom, utility room	≥ 90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

a. When tested in accordance with HVI Standard 916.

Reason: Changes to Table R405.5.2(1):

Ventilation system type is often selected as a function of climate, with supply systems seeing greater specification in the warm climates and exhaust systems seeing greater specification in cold climates. In keeping with ANSI/RESNET 301, this proposed change would compare the performance of the proposed design's ventilation system type with a comparable code-minimum ventilation system type for the reference home. The advantage of this change is that it permits builders and designers to select climate appropriate ventilation systems without receiving an automatic energy penalty that could be associated with the system type. As currently written, a builder selecting a heating or energy recovery ventilator (H/ERV) that meets the code minimum fan efficacy of 1.2 cfm/W would be penalized for not meeting the code minimum exhaust fan efficacy of 2.8-3.5 cfm/W, as determined by Table R403.6.1.

If approved, following are examples of how the reference home would be modeled based on the selection of the proposed design:

1. If the proposed design specifies an H/ERV, the reference home would be modeled with a balanced system without heat or energy recovery and having a fan efficacy of 1.2 cfm/W.
2. If the proposed design specifies a central fan integrated (CFI) system, the reference home would be modeled with an in-line supply fan with an efficacy of 3.8 cfm/W.
3. If the proposed design specifies a bathroom exhaust fan with a flow rate ≥ 90 cfm, the reference home would be modeled with an exhaust fan with an efficacy of 2.8 cfm/W.

Changes to Table R403.6.1:

Changes proposed to this table are for clarification and simplification. First, the table should not be based on the location of the fan but on the type of fan being installed. For example, an HRV or ERV is not a location, but a system type. Balanced fans without heat recovery are currently omitted from the table, and should be listed along side HRVs and ERVs, which are also balanced systems. Because balanced fans are grouped with HRVs and ERVs, the use of the term "in-line fan" should be clarified to include supply and exhaust in-line systems (also not a location, but a system type). Finally, if a "bathroom" fan is installed in a hallway to provide ventilation (a typical installation location for whole-house mechanical ventilation systems), the current table is silent on the minimum efficacy required, because it does not address "hallway" fans. So, this proposal combines typical bathroom, utility room, and hallway exhaust fans into the category of "other exhaust fans"; no changes are made to the fan efficacies for these products. The last column can be deleted by changing the "Air Flow Rate Minimum" column heading to "Air Flow Rate".

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Ultimately, ventilation system selection is up to the builder, so there is no increase or decrease in the cost of construction associated with this code change proposal.

RE178-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Concerns for reduction in energy efficiency based on the way mechanical ventilation is calculated in the performance path

(Vote: 9-1).

Assembly Action:

None

RE178-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Submitted

Commenter's Reason: There was some confusion at the Committee Action Hearings as to the intent and effect of this proposal. The committee approved RE178's changes to Table R403.6.1 with their action on RE137 as submitted, establishing fan efficacy requirements according to ventilation system type. That action reduces the net change proposed by RE178 to Table R405.5.2(1) as follows:

1. Set the reference design's mechanical ventilation system type to the same type as the proposed design, and
2. Set the efficacy of the reference design's mechanical ventilation system type to the minimum efficacy of the corresponding system type in Table R403.6.1.

These two changes ensure that when selecting a ventilation system type, there is an apples-to-apples comparison between the reference and the proposed design. This ensures that the ventilation system that is selected for the proposed design is compared to a comparable high-efficacy model within the same system type, and is not unduly penalized or rewarded for its performance based on system type alone. For example, without this PC, if a builder using the 2021 IECC specifies a supply ventilation system with an efficacy of 3.5 cfm/W for the proposed design (the minimum efficacy required in Table R403.6.1, based on the IECC-R Committee Action Hearing's as-submitted ruling on RE133), the performance path would credit the proposed design's supply fan for energy savings versus the reference home's exhaust fan with a minimum efficacy of 2.8 cfm/W. Conversely, if a builder specified an HRV with an efficacy of 1.2 cfm/W (the minimum efficacy required for HRVs in Table R403.6.1), then he would be penalized for not meeting the minimum exhaust fan efficacy of 2.8 cfm/W. By requiring the comparison between the proposed and reference designs to be within system type, RE178's changes to Table R405.5.2(1) would incentivize builders for selecting best-in-class products and would avoid steering them toward selecting a certain system type that may not be appropriate for their climate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposed change improves accounting for energy savings of ventilation systems by comparing them with systems of similar type. It does not consistently increase or decrease construction costs.

Public Comment# 1899

RE182-19

IECC: R406.2 (IRC N1106.2) , TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R406.2 (IRC N1106.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as “Mandatory” and Section R403.5.3 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2018 *International Energy Conservation Code*.

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^a
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

~~a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.~~

Reason: The purpose of this code change proposal is to make two important updates to the Energy Rating Index.

First, this proposal makes an editorial improvement by moving footnote “a” of Table R406.4 into Section R406.2, which contains the other mandatory requirements for the ERI. Given that two different thermal envelope backstops apply to the ERI depending on whether on-site renewable energy is included in the calculation, it makes sense to put these two backstops side-by-side in the same section of the code to reduce or eliminate any confusion.

Second, this proposal will update the enhanced thermal envelope backstop for homes with on-site renewable energy from the 2015 to the 2018 IECC, maintaining the same approach as set in the 2018 IECC – specifically, using the prescriptive path from the previous code as a backstop in this situation. This backstop is crucial to use of the ERI with on-site renewable energy. We continue to be concerned about the potential magnitude of trade-off credit that may apply if on-site generation is included in the ERI calculation. Analyses have shown that homes can achieve a 20-40 HERS points reduction with average-sized solar PV systems, which would allow enormous trade-offs of the home’s permanent envelope efficiency. See, e.g., RESNET, *The Impact of Photovoltaic Arrays on the HERS Index* (2015); and https://www.energycodes.gov/sites/default/files/documents/ECodes2016_06_Haack.pdf. Without reasonable limits on these solar trade-offs, homes with on-site generation could be built with far less efficiency, including substandard thermal envelopes, creating long-term problems for homeowners and reversing many of the benefits created by the IECC over the past 10 years.

Bibliography: RESNET, *The Impact of Photovoltaic Arrays on the HERS Index* (2015); and https://www.energycodes.gov/sites/default/files/documents/ECodes2016_06_Haack.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The editorial change to move the footnote into Section R406.2 will have no cost impact, and because the 2018 IECC incorporated only very moderate increases in efficiency over the 2015 IECC (primarily window improvements with no real upgrade cost), we expect no real cost impact. Moreover, this enhanced backstop only applies to homes built to the ERI that incorporate on-site power production into the ERI calculation, which is currently a very small percentage of all code-compliant homes. Code users can also avoid any cost increase by using other compliance alternatives.

RE182-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is no cost information, and proponent testimony and reason statement differed on whether the change to the 2018 IECC as a baseline was intended (Vote 9-2).

Assembly Action:

None

RE182-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R406.2 (IRC N1106.2)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.2 (IRC N1106.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as “Mandatory” and Section R403.5.3 be met. ~~In addition, the following requirements shall be met: The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2018 International Energy Conservation Code.~~

1. Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, the proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA calculated using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum glazed fenestration SHGC permitted in Climate Zones 1 through 3 shall be 0.30.

$$UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}} \quad \text{Equation 4-1}$$

2. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA calculated using the prescriptive U-factors from Table R402.1.4 in accordance with Equation 4-2. The area-weighted maximum glazed fenestration SHGC permitted shall be the SHGC values set forth in Table R402.1.2.

$$UA_{\text{Proposed design}} \leq UA_{\text{Prescriptive reference design}} \quad \text{Equation 4-2}$$

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

Commenter's Reason: This proposal should be approved as modified or as submitted because it will update and improve the thermal envelope backstops applicable to the ERI compliance path, improving comfort and helping to ensure long-term energy efficiency for each home.

There are two thermal backstops currently applicable to ERI compliance (with and without on-site generation). The current backstop applicable where on-site renewables are not used, applies values from the 2009 IECC. The current backstop applicable where on-site renewables are used applies more stringent 2015 IECC values. In RE150, the Committee recommended a revised backstop format for the situation where on-site renewables are not used that includes a total UA approach and a multiplier to replace a reference to an earlier version of the IECC.

The proposed modification will make the two backstops consistent with the new approach endorsed by the Committee and many of the participants by applying the revised backstop format approved by the Committee under RE150 to both backstops. It should be noted that this proposal, like RE150, includes a 1.15 multiplier for the non-on-site renewable backstop since that backstop is based on 2009 IECC requirements (this multiplier has the effect of diluting the efficiency of current IECC prescriptive requirements to make them more comparable to the 2009 values). By contrast, there is no multiplier included in our proposal for the on-site renewable backstop since it currently references the 2015 IECC requirements, which are much more efficient and very close to current envelope requirements.

These modifications would provide additional flexibility for builders to achieve a reasonably efficient thermal envelope under the ERI. These backstops would replace references to old versions of the IECC with internal references to the current code. With this change, the new Total UA-based equation (for homes with and without on-site renewables) will update automatically with each new edition of the code, eliminating the need to constantly review and update these important provisions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

As stated in the original proposal, the editorial change to move the footnote into Section R406.2 will have no cost impact, and because the 2018 IECC incorporated only very moderate increases in efficiency over the 2015 IECC (primarily window improvements with no real upgrade cost), we expect no real cost impact. Moreover, this enhanced backstop only applies to homes built to the ERI that incorporate on-site power production into the ERI calculation, which is currently a very small percentage of all code-compliant homes. Code users can also avoid any cost increase by using other compliance alternatives.

Public Comment# 1494

RE184-19

IECC: R406.3 (IRC N1106.3)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 except for buildings covered by the International Residential Code, the ERI Reference Design Ventilation rate shall be in accordance with Equation ~~4-1~~, 4-1.

Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]
(Equation 4-1)

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed 5 percent of the total energy use.

Reason: The purpose of this code change proposal is to help ensure that homes are built to an appropriate level of efficiency, irrespective of the amount of on-site generation that may be installed. The proposal adopts a 5 percent cap on the trade-off credit allowed for on-site power in the Energy Rating Index, similar to the 5 percent cap that applies in the simulated performance analysis of the 2018 IECC commercial chapter, Section C407.3, and ASHRAE Standard 90.1-2016 Energy Cost Budget Method.

- **2018 IECC C407.3:** "...The reduction in energy cost of the proposed design associated with on-site renewable energy shall be not more than 5 percent of the total energy cost."
- **ASHRAE Standard 90.1-2016, Section 11.4.3.1:** "...The reduction in *design energy cost* associated with *on-site renewable energy* shall be no more than 5% of the calculated *energy cost budget*."

It is important to note that this proposal does not limit the amount of on-site power production that can be installed on the home, nor does it apply any sort of "penalty" to homes with on-site power. The proposal simply recognizes that a reduction in energy use is not the same thing as on-site energy production, for purposes of code compliance. This proposal also supports the long-term goal of achieving net zero energy use by helping avoid steps backward in efficiency as on-site generation increases. If unlimited efficiency trade-off credit is allowed for increases in on-site generation, progress toward net-zero energy will stall. We do not see any good reason to allow steps backward in efficiency when it can be improved simultaneously with increases in on-site power production.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will increase the cost of construction only if user selects the ERI compliance path and the cost of increased on-site power production is less than a commensurate amount of energy efficiency. However, given the long expected useful life of a home's permanent features (such as thermal envelope efficiency), we believe homeowners will experience lower costs and reduced risk over the long-term if trade-off credit for on-site power production is reasonably limited.

RE184-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on the proponents request for disapproval (Vote 11-0).

Assembly Action:

None

RE184-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted as a reasonable limit on the use of renewable energy for compliance purposes in the ERI in order to ensure that every new home is also reasonably efficient overall.

An unlimited use of renewable energy for compliance could result in an inefficient home with a lot of on-site generation. We believe that this approach is backwards and that a home should first be designed to optimize energy efficiency and then on-site renewables should be added to make the home even more sustainable. This same approach has been recognized in the commercial energy code, which also applies a 5% limit on compliance credit from on-site renewables. It is important to recognize that these limits do not prevent adding more on-site generation; they simply limit the amount of code compliance credit from such generation that can be used to offset/replace required energy efficiency.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As stated in the original proposal, this will increase the cost of construction only if the user selects the ERI compliance path and the cost of increased on-site power production is less than a commensurate amount of energy efficiency. However, given the long expected useful life of a home's permanent features (such as thermal envelope efficiency), we believe homeowners will experience lower costs and reduced risk over the long-term if trade-off credit for on-site power production is reasonably limited.

Public Comment# 1495

RE186-19

IECC: R406.3 (IRC N1106.3)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Energy Conservation Code

Revise as follows:

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 ~~except for buildings covered by the International Residential Code, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-1.~~

~~Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]~~

~~(Equation 4-1)~~

Exceptions:

1. For Table 4.2.2(1) of RESNET/ICC 301, the Reference Home and Rated Home air exchange rates shall be as specified for the air exchange rates in Table R405.5.2(1) of this code.
2. For Table 4.3.1(1) of RESNET/ICC 301, the air exchange rate shall be as specified for the air exchange rate for the standard reference design in Table R405.5.2(1) of this code.
3. The proposed ventilation rate shall comply with the mechanical ventilation requirements of Section M1505 of the International Residential Code or Section 403.3.3.2.1 of the International Mechanical Code.

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

Reason: RESNET/ICC 301 uses the ASHRAE 62.2 ventilation rate not the IRC and IMC ventilation rate. Following the ASHRAE 62.2 ventilation rate results in over ventilation in hot humid climates and cold climates and excessive energy use in all climates. In hot humid climates the resulting part load humidity problems result in mold. In cold climates the high ventilation rates result in excessive dryness. Beyond the problems created by over ventilation, this is also a policy issue. Ventilation rates are set in the I-code development process, not by RESNET. The ERI is being used to show compliance with the I-codes. The IRC and the IMC set building code ventilation rates not RESNET. The ERI should be determined using building code ventilation rates specified by the IRC and the IMC not by RESNET.

RESNET/ICC 301 by following ASHRAE 62.2 also modifies the mechanical ventilation rate required based on infiltration measurements and this results in discouraging better building practices. Tighter houses are penalized compared to leakier houses which makes no sense. If a builder constructs a leakier house then the mechanical ventilation rate is reduced according to RESNET/ICC 301 and ASHRAE 62.2. Infiltration should not be relied on to provide ventilation in new code compliant house construction where enclosures are constructed to 3 ach@50 Pa and 5 ach@50 Pa. Finally, ventilating at a higher, and unnecessary, ventilation rate wastes energy.

If RESNET has an issue with the IRC and the IMC ventilation rates then RESNET should change the ventilation rates using the ICC code change process and not force the use of the ASHRAE 62.2 ventilation rates to judge I-code compliance.

The existing wording has proved confusing. The proposed wording is much clearer. This code change requires that the IRC and IMC ventilation rates be used to determine the ERI.

Cost Impact: The code change proposal will decrease the cost of construction

For those who believe they have to use ASHRAE 62.2 ventilation rates this reduce costs. Even if done "right" over ventilation increases costs due to the costs of dealing with excessive moisture, overly dry air, or moisture damage in some climates.

RE186-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: The agreement among the parties fixes the ventilation the issue (Vote: 8-3).

Assembly Action:

None

RE186-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R406.3 (IRC N1106.3)

Proponents:

Cy Kilbourn, Ekotrope, representing Ekotrope

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301.

Exceptions:

1. In Table 4.2.2(1) of RESNET/ICC 301, the Reference Home air exchange rate shall be modified to match the Reference Design air exchange rate in Table R405.5.2(1) of this code, except that the air leakage rate (not including ventilation) shall be a Specific Leakage Area (SLA) of 0.00036.
2. In Table 4.2.2(1) of RESNET/ICC 301, the Rated Home air exchange rate shall be modified to match the Proposed Design air exchange rate in Table R405.5.2(1) of this code.
3. The ventilation rate shall comply with the mechanical ventilation requirements of Section M1505 of the International Residential Code or Section 403.3.2.1 of the International Mechanical Code. Any adjustments required or allowed by RESNET/ICC 301 that change the code-required ventilation rates shall be prohibited.

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

Commenter's Reason: This amendment is intended to prevent the probably unintended consequence of RE186-19, which is that R406 ERI scores would be significantly shifted upward from RESNET/ICC 301 ERI scores because of the reduction in Reference Home infiltration rate. Such a shift would make compliance with path R406 much more difficult to achieve, since the target ERI scores were developed based on RESNET/ICC 301 ERI scores. This amendment prevents that significant upward ERI shift.

This amendment also maintains the intent of the original RE186-19 in that it achieves the following:

- ASHRAE 62.2 ventilation rates are completely eliminated from the Proposed and Reference designs. IRC ventilation rates are used instead. Thus, infiltration is not recognized as a means of providing indoor air quality.
- The home will receive a lower ERI score if it ventilates down to IRC levels rather than ASHRAE 62.2 levels.
- Clarification is made that ASHRAE 62.2 rates are **not** mandatory - IRC rates are.

The difference is that it keeps the ERI scores from increasing significantly by keeping the base *infiltration* rate the same while still modifying the

ventilation rates. Summary below:

Infiltration + Ventilation

Unabridged RESNET/ICC 301 Reference Home: 0.00036 SLA + ASHRAE 62.2-2013 ventilation

Original RE186-19 Reference Home: 3 or 5 ACH50 + IRC ventilation

Proposed amended RE186-19 Reference Home: 0.00036 SLA + IRC ventilation

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This amendment will significantly decrease cost of construction because it will lower R406 ERI scores back down to the levels intended during the original development of R406 and make compliance with the R406 path more achievable.

Public Comment# 1919

RE190-19

IECC: R406.4 (IRC N1106.4), TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Revise as follows:

R406.4 (IRC N1106.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design including renewable energy systems* be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.4 when compared to the *ERI reference design*.

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX*
1	57 <u>52</u>
2	57 <u>52</u>
3	57 <u>51</u>
4	62 <u>54</u>
5	61 <u>55</u>
6	61 <u>54</u>
7	58 <u>53</u>
8	58 <u>53</u>

~~a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.~~

Reason: The Energy Rating Index is a voluntary path that ensures robust insulation and envelope measures while enabling on-site renewables that enhance the affordability of a home in select climate zones.

In the process of development of the 2018 IECC, in the Public Comment version of RE173-16 the ERI target scores were increased (relaxed) and Footnote a was added to treat projects differently if they do or do not incorporate an on-site renewable energy system. Projects that include a renewable energy system to offset consumption of energy and reduce energy flows at the meter are not rewarded in this revised approach, but are penalized by requiring a higher level of envelope measures. Footnote a requires IECC 2015 envelope backstop for projects with on-site renewable energy systems or 2009 envelope backstop for projects without on-site renewable energy systems. The result is an ERI compliance option that focuses on the building envelope with less-stringent target scores that can be attained without renewable energy systems -- a disincentive for builders to use renewable energy systems in the ERI path.

As presented by the Building Technologies Office of the Department of Energy's 2018 National Energy Codes Conference, according to the U.S. Energy Information Administration's AEO 2018 report, typical Residential End Uses include Space heating at 24% and Space cooling at 11%, for a combined space heating/cooling at 35% of all Residential Energy End Uses. Water heating accounts for 13.5% of Residential Energy End Uses. These figures illustrate that we have done a very good job of reducing regulated loads, such that unregulated loads (such as lighting loads, appliance loads, and plug loads) now represent greater than 50% of all Residential Energy End Uses. Renewable energy systems can offset not only the unregulated loads, but can also offset the reduced regulated loads.

Compliance measures and compliance paths that focus only on building envelope measures and discourage or penalize renewable energy systems - or fail to make renewable energy systems attractive to builders as a compliance option -- are focused on solving 35% of the problem. The IECC should encourage the use of energy efficiency plus renewable energy, to solve 100% of the problem. In fact, new homes with PV systems and EV chargers can also power our consumer vehicles with sunlight, solving greater than 100% of the building energy problem.

This proposal restores the lower, more stringent ERI target values of the 2015 IECC and again makes renewable energy systems an attractive option for builders.

Effective integration of energy efficiency measures and renewable energy systems is critical to the future of energy codes and green/stretch/reach codes. At the time of submittal of these code change proposals, there are four states with 100% renewable energy goals: Hawaii, California, New Jersey, and New York. Other communities are committing to renewable energy goals through their own local renewable goals for power supply or for installation of renewable energy systems. Distributed Generation (DG) is an important component of these overall portfolio standards.

Bibliography: U.S. Energy Information Administration Annual Energy Outlook 2018
<https://www.eia.gov/outlooks/aeo/index.php>

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal encourages the installation of renewable energy systems, which provides more flexibility to the builder and could result in either increased or decreased first cost of construction, depending on builder choices.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on previous previous code actions on EIR scores (Vote: 11-0).

Assembly Action:

None

RE190-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R406.4 (IRC N1106.4), TABLE R406.4 (IRC N1106.4)

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.4 (IRC N1106.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design including renewable energy systems* be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.4 when compared to the *ERI reference design*.

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	<u>ENERGY RATING INDEX FOR RATED DESIGNS NOT INCORPORATING RENEWABLE ENERGY</u>	<u>ENERGY RATING INDEX FOR RATED DESIGNS INCORPORATING RENEWABLE ENERGY</u>
1	<u>57</u>	52
2	<u>57</u>	52
3	<u>57</u>	51
4	<u>62</u>	54
5	<u>61</u>	55
6	<u>61</u>	54
7	<u>58</u>	53
8	<u>58</u>	53

Commenter's Reason:

Background:

The IECC-Residential Committee approved RE150-19 by unanimous vote of 11-0.

Committee Reason: The proposal [RE150-19] as modified removed the 2009 IECC reference and retained the 15% UA backstop, the modification replaced the SHGC (Vote 11-0).

$$UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}} \quad \text{Equation 4-1}$$

By this IECC-R committee action, there is no longer a 2009 IECC envelope backstop in the ERI method of R406.

For this Public Comment:

This proposal, RE190-19, seeks to remove Footnote a, which requires a 2015 envelope backstop for rated designs incorporating renewable energy, to create a level playing field for envelope backstop. If RE190-19 is successful AMPC, then all rated designs using the ERI method would be subject to the same UA envelope backstop, for greater consistency and less confusion.

This public comment creates a second column in Table R406.4, such that rated designs incorporating renewable energy are held to a lower, more-stringent ERI score.

The first column -- ERI for rated designs not incorporating renewable energy are held to 2018 ERI scores, which are higher and less stringent.

The second column -- ERI for rated designs incorporating renewable energy are held to the 2015 ERI scores, which are lower and more stringent.

The two-column format provides a foundation for revision of ERI scores in future editions of the IECC, for rated designs with and without renewable energy. The format is consistent with Proposal RE223-19, which could be viewed as a companion proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposal encourages the installation of renewable energy systems, which provides more flexibility to the builder and could result in either increased or decreased first cost of construction, depending on builder choices.

RE192-19

IECC: TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^a
1	57 <u>52</u>
2	57 <u>52</u>
3	57 <u>51</u>
4	62 <u>54</u>
5	61 <u>55</u>
6	61 <u>54</u>
7	58 <u>53</u>
8	58 <u>53</u>

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

Reason: The purpose of this code change proposal is to establish lower, more efficient ERI target scores, improving efficiency for homes complying under the Energy Rating Index. More precisely, the proposal restores the lower ERI Index target scores from the 2015 IECC. Under the ERI, the lower the score, the more efficient the home. Although the ERI numbers were increased to the current levels as part of a broad compromise in the 2018 IECC, we believe that over time the ERI must continue to be improved, and improving the Index numbers by returning to the 2015 IECC levels at some point is a reasonable first step in the right direction.

Although a direct comparison between the ERI and other IECC compliance options is complicated, the ERI numbers proposed (and those in the 2015 IECC) are within the range of equivalence to other compliance paths under the IECC. U.S. DOE published an analysis that compared compliance under the IECC with HERS scores, using over 60,000 model runs to test the range of HERS scores that could apply to a 2012 IECC-compliant home. The study found that the 2015 ERI scores would be more likely to ensure compliance with the IECC, but even those scores could not guarantee compliance. "Thus, one can conclude that the [2015 IECC] ERIs are generally very near the conservative end of possible values, but not quite so low as to always guarantee that a home complying via the ERI path would also comply via the Performance Path." See U.S. Department of Energy, *Identification of RESNET HERS Index Values Corresponding to Minimal Compliance with the IECC Performance Path*, at 4.17 (May 2014). Given that the other compliance options in the IECC have moderately improved since the 2012 IECC, we believe that these more stringent ERI scores would be appropriate as an upgrade to the current less efficient ERI levels for 2021.

Bibliography: See U.S. Department of Energy, *Identification of RESNET HERS Index Values Corresponding to Minimal Compliance with the IECC Performance Path*, at 4.17 (May 2014).

Cost Impact: The code change proposal will increase the cost of construction

To achieve a lower ERI score, builders must install more efficient products or systems in homes, which will increase construction costs. Because the ERI is a performance-based path, the costs and benefits to the consumer will vary depending on which improvements are incorporated into the home design. However, since the ERI is not mandatory and is one of only several compliance options, builders are not required to use this option if they do not find it acceptable for a specific project.

RE192-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This path is an above code program, this path is just getting its feet under it and raising it too high will eliminate use (Vote: 10-1).

Assembly Action:

None

RE192-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it would improve the efficiency of the Energy Rating Index compliance path by restoring the more robust ERI values that were part of the original ERI in the 2015 IECC (and which were weakened in the 2018 edition). It should go without saying that the Energy Rating Index should improve over time, just as other compliance options improve. However, unlike the performance and Total UA paths, which improve automatically when parts of the prescriptive path improve, the ERI is based on a different (fixed) baseline that will not improve by itself. It is thus important to revisit the ERI scores each code update cycle to determine whether an update is necessary.

The ERI scores from the 2015 IECC have been adopted in several states, and we believe they are just as reasonable now as they were when the ERI was first incorporated into the 2015 IECC. Even though these scores were increased (which reduced their stringency) in 2018 as part of a broad compromise, the U.S. DOE found (in the study cited in the original supporting reason) that the more robust 2015 ERI scores were within the range of equivalency with the 2012 IECC prescriptive path. Given the improvements incorporated into the prescriptive path of the IECC since 2012, we believe the 2015 scores (or even more efficient scores) are well-justified. If the 2015 ERI scores were reasonable enough for approval 5 or 6 years ago, they are even more reasonable today.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As stated in the proposal, to achieve a lower ERI score, builders must install more efficient products or systems in homes, which will increase construction costs. Because the ERI is a performance-based path, the costs and benefits to the consumer will vary depending on which improvements are incorporated into the home design. However, since the ERI is not mandatory and is one of only several compliance options, builders are not required to use this option if they do not find it acceptable for a specific project.

Public Comment# 1496

RE194-19

IECC: R202 (IRC N1101.6), TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^{a,b}
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. In a state, region, or country that has a renewable portfolio standard of 50% or greater, on-site renewable electric energy production systems shall receive credit only where they are installed with an on-site energy storage system that has a rated capacity of at least 3.5 kWh.

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

RENEWABLE PORTFOLIO STANDARD (RPS). A policy that requires electricity producers within a given jurisdiction to supply a certain minimum amount, capacity, or percentage of their electricity from designated renewable resources.

Reason: More states / areas of the United States are increasing their Renewable Portfolio Standards. As more distributed renewable electric energy systems are installed, there are situations where there is too much supply and too little demand, especially in the fall, winter, and spring. In California, this has been called the "duck curve". In Hawaii, this has been called the "Nessie curve". In these cases, the grids are dealing with the issue of oversupply. In 2018, the California ISO had to curtail over 461,000 MWh (461 Million kWh) of solar and wind electric generation.

Energy storage, both grid-side and customer-side, will be needed to help address this situation. With energy storage, there is much less likelihood (or even no chance) that renewable electricity will be curtailed or not used.

In the newest version of Title 24, builders are allowed to adjust the size of residential PV systems if they also installed energy storage systems in combination with the PV.

This proposal is forward looking and will help both homeowners and the grid in the future, especially in areas with aggressive Renewable Portfolio Standards.

The definition is needed for support of the new language in the proposal. This is an "umbrella" definition that encompasses all of the variations of RPS policies throughout the United States (and world). RPS policies vary on a state by state basis, as there is no federal standard in the United States. However, in other countries that use the IECC, there may be country-wide policies that would be in effect.

More details about RPS policies can be found on numerous web sites, including the following:

<https://www.eia.gov/todayinenergy/detail.php?id=4850> (US DOE/EIA article from 2012)

<http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/10/Renewable-Portfolio-Standards-2018.pdf>

<http://programs.dsireusa.org/system/program?type=38&>

Bibliography: California ISO, "What the duck curve tells us about managing a green grid", 2016, https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

NREL, "Overgeneration from Solar Energy in California: A Field Guide to the Duck Chart", November 2015
<https://www.nrel.gov/docs/fy16osti/65023.pdf>

GTM, "Hawaii's Solar-Grid Landscape and the 'Nessie Curve' ", February 10, 2014, <https://www.greentechmedia.com/articles/read/hawaiis-solar-grid-landscape-and-the-nessie-curve>

Cost Impact: The code change proposal will increase the cost of construction

Based on current battery technology and costs, the estimated cost impact will be approximately \$1750 (3.5 kWh * \$500/kWh installed) for homes that are located in areas with high RPS requirements and that install on-site renewable electric energy generation systems.

RE194-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This would negatively detract from using solar or other renewables, further demonstrates the complexity of the issue. The issues have not been worked out yet on safety issues (Vote: 11-0).

Assembly Action:

None

RE194-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R406.4 (IRC N1106.4)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^{a,b}
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. In a state, region, or country that has a renewable portfolio standard of 50% or greater, on-site renewable electric energy production systems shall receive credit only where they are installed with an on-site energy storage system that has a rated capacity of at least ~~3.5~~ 2.0 kWh.

Commenter's Reason: In states or regions with higher levels of Renewable Portfolio Standards, on-site energy storage will help the homeowner as well as the local grid.

This modification reduces the size of the battery requirement, which will result in lower cost impacts compared to the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment reduces the increase in the cost of construction by reducing the required size (and the cost) of the batteries in the on-site energy storage system.

Public Comment# 1372

Public Comment 2:

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason: More states / areas of the United States are increasing their Renewable Portfolio Standards. As more distributed renewable electric energy systems are installed, there are situations where there is too much supply and too little demand, especially in the fall, winter, and spring.

In California, this has been called the "duck curve". In Hawaii, this has been called the "Nene curve". In these cases, the grids are dealing with the issue of oversupply. In 2018, the California ISO had to curtail over 461,000 MWh (461 Million kWh) of solar and wind electric generation. As of July 18, 2019, the California ISO has already curtailed over 697,000 MWh (697 Million kWh) of solar and wind generation in 2019. Energy storage, both grid-side and customer-side, will be needed to help address this situation. With energy storage, there is much less likelihood (or even no chance) that renewable electricity will be curtailed or not used.

In the newest version of Title 24, builders are allowed to adjust the size of residential PV systems if they also installed energy storage systems in combination with the PV. This proposal is forward looking and will help both homeowners and the grid in the future, especially in areas with aggressive Renewable Portfolio Standards.

The definition is needed for support of the new language in the proposal. This is an "umbrella" definition that encompasses all of the variations of RPS policies throughout the United States (and world). RPS policies vary on a state by state basis, as there is no federal standard in the United States. However, in other countries that use the IECC, there may be country-wide policies that would be in effect.

More details about RPS policies can be found on numerous web sites, including the following:

<https://www.eia.gov/todayinenergy/detail.php?id=4850> (US DOE/EIA article from 2012)

<http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/10/Renewable-Portfolio-Standards-2018.pdf>

<http://programs.dsireusa.org/system/program?type=38&>

Bibliography:

California ISO, "What the duck curve tells us about managing a green grid", 2016

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Based on current battery technology and costs, the estimated cost impact will be approximately \$1750 (3.5 kWh * \$500/kWh installed) for homes that are located in areas with high RPS requirements and that install on-site renewable electric energy generation systems.

Public Comment# 1571

RE195-19

IECC: TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^{a,b}
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. Where the installation of an on-site renewable energy system is a mandatory requirement in the code, the building shall receive credit only for the capacity installed that is above the minimum mandatory requirement.

Reason: In California, the latest version of Title 24 will go into effect on 1/1/2020. In the energy code, there is a requirement for new homes to install on-site PV systems, based on the following formula:

$kW PV = (CFA \times A)/1000 + (NDwell \times B)$ where

kW PV = kWdc size of the PV system

CFA = Conditioned floor area

NDwell = Number of dwelling units

A = Adjustment factor from Table 150.1-C (range of 0.572 to 1.56)

B = Dwelling adjustment factor from Table 150.1-C (range of 1.06 to 1.51)

There are exceptions to the requirement, but most homes will be required to install systems that range in size from 2 to 5 kW.

Under the ERI compliance path, homes with such systems get credits (lower scores). However, if such systems are already required by the code, should they receive full credit?

With other efficiency programs, once the federal or state baseline is increased (e.g., 10 to 13 SEER, for example), the incentives for the 13 SEER system disappear, since it is no longer a "high efficiency" option, but a required minimum standard.

This proposal follows that precedent. Systems that meet the mandated minimum requirements should not receive credit, since they are not going "above and beyond" what is required. Only systems that exceed the minimum requirements should get credit for the incremental energy production they are providing.

Bibliography: California Energy Commission, "**2019 Standards Part 6 Chapter 8 (Section 150.1) Revised Express Terms**" TN-223257-3 Submitted 4/23/2018 https://www.energy.ca.gov/title24/2019standards/rulemaking/documents/2018-05-09_hearing/2019_Revised_EnergyCode.php NREL, "*U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018*", November 2018 <https://www.nrel.gov/docs/fy19osti/72399.pdf>

Cost Impact: The code change proposal will increase the cost of construction

Where the PV system is sized larger than the required minimum, the extra cost will be on the order of \$2,700 per kW (DC) of incremental peak rated capacity. The value is based on the November 2018 NREL report on US solar installations at residential facilities.

For example, if the minimum requirement is 3 kW (DC), and a 5 kW (DC) system is installed, the extra cost will be approximately \$5,400.

RE195-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Since there are no requirements for mandatory renewables, this is premature (Vote: 11-0).

Assembly Action:

None

RE195-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R406.4 (IRC N1106.4)

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^{a,b}
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. Where the installation of an on-site renewable energy system is a mandatory requirement in the code, the building shall receive credit only for the On-site Renewable Energy capacity installed that is above the minimum mandatory requirement. On-site Renewable Energy shall receive credit for 100% of the installed electrical or thermal capacity.

Commenter's Reason:

In California, the latest version of Title 24 will go into effect on 1/1/2020. In the energy code, there is a requirement for new homes to install on-site PV systems, based on the following formula:

$$\text{kW PV} = (\text{CFA} \times \text{A})/1000 + (\text{NDwell} \times \text{B}) \text{ where}$$

kW PV = kWdc size of the PV system

CFA = Conditioned floor area

NDwell = Number of dwelling units

A = Adjustment factor from Table 150.1-C (range of 0.572 to 1.56)

B = Dwelling adjustment factor from Table 150.1-C (range of 1.06 to 1.51)

There are exceptions to the requirement, but most homes will be required to install systems that range in size from 2 to 5 kW.

Under the ERI compliance path, homes with such systems get credits (lower scores). However, if such systems are already required by the code, should they receive full credit?

With other efficiency programs, once the federal or state baseline is increased (e.g., 10 to 13 SEER, for example), the incentives for the 13 SEER system disappear, since it is no longer a "high efficiency" option, but a required minimum standard.

This proposal follows that precedent. Systems that meet the mandated minimum requirements should not receive credit, since they are not going "above and beyond" what is required. Only systems that exceed the minimum requirements should get credit for the incremental energy production they are providing.

In addition, it allows 100% credit for the installation of non-electric renewable energy systems, such as geothermal, biomass, and solar thermal. Solar thermal is inherently less complex with respect to export/import than PV.

Bibliography: California Energy Commission, "**2019 Standards Part 6 Chapter 8 (Section 150.1) Revised Express Terms**" TN-223257-3 Submitted 4/23/2018 https://www.energy.ca.gov/title24/2019standards/rulemaking/documents/2018-05-09_hearing/2019_Revised_EnergyCode.php NREL, "*U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018*", November 2018 <https://www.nrel.gov/docs/fy19osti/72399.pdf>

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The net effect of the public comment and code change proposal will increase the cost of construction. Where the PV system is sized larger than the required minimum, the extra cost will be on the order of \$2,700 per kW (DC) of incremental peak rated capacity. The value is based on the November 2018 NREL report on US solar installations at residential facilities.

For example, if the minimum requirement is 3 kW (DC), and a 5 kW (DC) system is installed, the extra cost will be approximately \$5,400.

Public Comment 2:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Submitted

Commenter's Reason: There is such a mandate in California that will go into effect on January 1, 2020. This proposal is needed to address that situation. There may be other cities and counties where such a mandate is being considered or will be implemented within the next several years.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost impact will be the same as in the original proposal, since this does not make any modifications.

RE196-19

IECC: TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^a
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be ~~greater than or equal to~~ within 15% of the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 ~~of the 2015 International Energy Conservation Code.~~

Reason: This modification gives on-site renewable energy a 15% credit of the current edition of the code when using the Energy Rating Index. It clears up confusion about calling reference to past editions of the IECC and enables the code user to use one edition of the code instead of referencing a past edition. As the code is written right now there is no credit for installing onsite renewable energy while mandating rigorous prescriptive requirement of the 2015 IECC with no room for flexibility. The prescriptive tables have been virtually untouched in the 2018 edition and could potentially go unchanged for cycles to come. The ERI path is intended to allow for flexibility while constructing an energy efficient home. The proposal gives a reasonable amount of flexibility without jeopardizing the integrity or efficiency of the homes. The 15% allowance will prevent from installing single pane windows and prevent significant reductions in building thermal envelope components.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This proposal does not change the cost of construction it increases the flexibility.

RE196-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It is confusing to send users to another section which also lists another value; there was not substantial analysis and it is not consistent with previous action on RE188 (Vote: 7-4).

Assembly Action:

None

RE196-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE R406.4 (IRC N1106.4)

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX ^a
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

- a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the proposed total building thermal envelope UA shall be less than or equal to the UA of the building thermal envelope using the prescriptive U-factors from Table R402.1.4 multiplied by 1.05. SHGC shall not exceed limits in Table R402.1.2. shall be within 15% of the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4

Commenter's Reason: This modification gives on-site renewable energy a 5% UA trade-off of the current edition of the code when using the ERI approach. It helps to address some of the concerns at the Committee Action Hearings with no backstops in place for SHGC, this public comment reduces the original 15% trade off down to 5% and sets in place and SHGC backstop to ease concerns. The existing language calls reference to past editions of the IECC which requires the use of two separate code versions to comply with the current, this helps clean up the language and removes the reference to past editions. Also, as the code is written right now there is no credit for installing onsite renewable energy while mandating rigorous prescriptive requirements of the 2015 IECC with no room for flexibility. The prescriptive tables have been virtually untouched in the 2018 editions. The ERI path is intended to allow for flexibility while constructing an energy efficient home. The public comment gives flexibility without jeopardizing the integrity or efficiency of the homes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change will not impact the cost of construction because it is not directly affecting how you construct a dwelling. This proposal gives more flexibility in the ERI path and does not require a building to do certain metrics.

Public Comment# 1419

RE202-19

IECC@: R406.6.2 (IRC N1106.6.2)

Proposed Change as Submitted

Proponents: Kirk Nagle, City of Aurora, representing Myself (knagle@auroragov.org)

2018 International Energy Conservation Code

Revise as follows:

R406.6.2 (IRC N1106.6.2) Compliance report. Compliance software tools shall generate a report that documents that the ERI of the *rated design* complies with Sections R406.3 and R406.4. The compliance documentation shall include the following information:

1. Address or other identification of the residential building.
2. Declare Energy Rating Index on title page
3. An inspection checklist documenting the building component characteristics of the *rated design*. The inspection checklist shall show results for both the *ERI reference design* and the *rated design*, and shall document all inputs entered by the user necessary to reproduce the results.
4. Name of individual completing the compliance report.
5. Name and version of the compliance software tool.

Exception: Where an otherwise identical building model is offered in multiple orientations, compliance for any orientation shall be permitted by documenting that the building meets the performance requirements in each of the four (north, east, south and west) cardinal orientations.

Reason: This code change is being proposed to clarify the energy path to the code official and the documentation for permit. Many reports do not specify the path that is being proposed and the code official has to contact the applicant to verify the energy path they are intending to use, to comply with the energy code. By providing the method of compliance the code official can focus on the details of the report and this information will expedite the permit process time.

Cost Impact: The code change proposal will increase the cost of construction
This will increase the cost of construction by a minor amount, adding a data entry to the report.

RE202-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is another proposal upcoming that puts it in the proper code section (Vote: 6-4).

Assembly Action:

None

RE202-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R406.6.2 (IRC N1106.6.2)

Proponents:

Kirk Nagle, representing Myself (knagle@auroragov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.6.2 (IRC N1106.6.2) Compliance report. Compliance software tools shall generate a report that documents that the ERI of the *rated design*

complies with Sections R406.3 and R406.4. The compliance documentation shall include the following information:

1. Address or other identification of the residential building.
2. Declare Energy Rating Index on title page and building plans.
3. An inspection checklist documenting the building component characteristics of the *rated design*. The inspection checklist shall show results for both the *ERI reference design* and the *rated design*, and shall document all inputs entered by the user necessary to reproduce the results.
4. Name of individual completing the compliance report.
5. Name and version of the compliance software tool.

Exception: Where an otherwise identical building model is offered in multiple orientations, compliance for any orientation shall be permitted by documenting that the building meets the performance requirements in each of the four (north, east, south and west) cardinal orientations.

Commenter's Reason: This code change proposal is needed to clarify the intentions of the builder , to expedite the plan review process and provide a clear path for the inspectors as the approve the building components. The intentions of the designer being stated on the plans and the energy report provides the plan reviewer a path to follow and will speed up the review process. Knowing where to look in the energy energy code for the requirements and compare that to the plans and the energy report make the process of plan review much quicker. As a inspector it reduces the inspection time by making it very clear what the intentions of the designer are so the inspector can follow the energy plan and compare it to the building as the building is constructed. This code change is being submitted to give the plan reviewer, and the inspector a very clear path to follow as the plans are reviewed and the building is constructed so the process can be expedited.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This code change will increase the cost of construction slightly- data entry.

Public Comment# 2105

RE204-19

IECC: R202 (IRC N1101.6), R406.6.3 (IRC N1106.6.3) (New)

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

RENEWABLE ENERGY CERTIFICATE (REC). *An instrument that represents the environmental attributes of one megawatt hour of renewable energy; also known as an energy attribute certificate (EAC).*

Add new text as follows:

R406.6.3 (IRC N1106.6.3) Renewable energy certificates (RECs) documentation. *Where onsite renewable energy is included in the calculation of an ERI, one of the following forms of documentation shall be provided to the code official:*

- 1. Substantiation that the RECs associated with the onsite renewable energy are owned by, or retired on behalf of, the homeowner.*
- 2. A contract that conveys to the homeowner the RECs associated with the onsite renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy.*

Reason: This proposal impacts who may claim the environmental attributes of an onsite-renewable energy system. The environmental attributes of solar power, or other renewable energy, have market value that is reflected and transacted in RECs.

When the installer, leasing company or financial agent in the solar panel transaction strips that value from the homeowner by taking possession of the RECs, according to the Federal Trade Commission the power produced by the solar panels on the house would have an "unqualified claim" as renewable energy. To prevent this, the proposal ensures that environmental attributes are not double counted towards compliance with the IECC. While this proposal does not cite Green-E, the Green-E Standard describes the double counting that occurs when RECs have been transferred to another party in the renewable transaction:

Examples of prohibited double uses include, but are not limited to:

- 1) When the same REC is sold by one party to more than one party, or any case where another party has a conflicting contract for the RECs or the renewable electricity;*
- 2) When the same REC is claimed by more than one party, including any expressed or implied environmental claims made pursuant to electricity coming from a renewable energy resource, environmental labeling or disclosure requirements. This includes representing the energy from which RECs are derived as renewable in calculating another entity's product or portfolio resource mix for the purposes of marketing or disclosure;*
- 3) When the same REC is used by an electricity provider or utility to meet an environmental mandate, such as an RPS, and is also used to satisfy customer sales under Green-e Energy; or*
- 4) Use of one or more attributes of the renewable energy or REC by another party This includes when a REC is simultaneously sold to represent "renewable electricity" to one party, and one or more Attributes associated with the same MWh of generation (such as CO2 reduction) are also sold, to another party.*

To prevent the situation where double counting is credited within the ERI calculation, thereby artificially reducing ERI scores and allowing the the home to install fewer energy efficiency features than otherwise would be required, this proposal ensures that the homeowner retains possession of the RECs associated with onsite renewable energy systems. In the case where those RECs for the onsite system cannot be transferred to the homeowner, an equivalent quantity of RECs must be provided.

Bibliography: Federal Register, Volume 77, Number 197; October 11, 2012; 16 CFR Part 260; "Guides for the Use of Environmental Marketing Plans".

Green-e Renewable Energy Standard for Canada and the United States, Version 3.2; March 20, 2018.

Cost Impact: The code change proposal will increase the cost of construction

This proposal impacts who may claim the environmental attributes of an onsite-renewable energy system. The environmental attributes of the solar power have market value, reflected in RECs. The cost of installing solar panels may be reduced when the installer, leasing company or financial agent strips that value from the homeowner by taking possession of the RECs.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is not a building or building code issue, it is a legal issue (Vote: 11-0).

Assembly Action:

None

RE204-19

Individual Consideration Agenda

Public Comment 1:

IECC@: R406.6.3 (IRC N1106.6.3) (New)

Proponents:

jim edelson, representing New Buildings Institute (jim@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.6.3 (IRC N1106.6.3) Renewable energy certificates (RECs) documentation. Where onsite renewable energy is included in the calculation of an ERI, ~~one of the following forms of documentation shall be provided to the code official:~~

- ~~1. Substantiation that the RECs associated with the onsite renewable energy are owned by, or retired on behalf of, the homeowner.~~
- ~~2. A contract that conveys to the homeowner the RECs associated with the onsite renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy.~~

the property owner or owner's authorized agent shall demonstrate that any RECs or EACs associated with onsite renewable energy are retained, or retired, on behalf of the property owner.

Commenter's Reason: Onsite renewable energy is termed Onsite Power Production (OPP) in RESNET 301, and the application of OPP in Section 4.1.2 of RESNET 301 directly reduces the estimated energy consumption for the rated house. That reduction in energy consumption then reduces the calculated Energy Rating Index (ERI) which is used for compliance with the IECC. At the same time that the on-site renewable energy is helping the rated home meet the IECC, the environmental attributes associated with that renewable energy are commonly being counted towards additional obligations, such as Renewable Portfolio Standards.

According to the Green-E Standard, double counting occurs when RECs are not tracked to a single party.

Examples of prohibited double uses include, but are not limited to:

- 1) When the same REC is sold by one party to more than one party, or any case where another party has a conflicting contract for the RECs or the renewable electricity;*
- 2) When the same REC is claimed by more than one party, including any expressed or implied environmental claims made pursuant to electricity coming from a renewable energy resource, environmental labeling or disclosure requirements. This includes representing the energy from which RECs are derived as renewable in calculating another entity's product or portfolio resource mix for the purposes of marketing or disclosure;*
- 3) When the same REC is used by an electricity provider or utility to meet an environmental mandate, such as an RPS, and is also used to satisfy customer sales under Green-e Energy; or*
- 4) Use of one or more attributes of the renewable energy or REC by another party This includes when a REC is simultaneously sold to represent "renewable electricity" to one party, and one or more Attributes associated with the same MWh of generation (such as CO2 reduction) are also sold, to another party.*

This Public Comment provides revised language that clarifies and simplifies the original proposal. The Solar Energy Industry Association (SEIA) assisted NBI in drafting these revisions. The Comment clarifies that the owner or her agent shall show that the ownership or retirement of RECs have been properly tracked to the owner. This information about the treatment of RECs is found in typical leases, contracts and incentive agreements for installed solar energy systems. A reference to the contractual provision is all that is needed to satisfy the requirements of this proposal – and this reference to the RECs provision in the plans set is all that the code official would need to examine.

As an example, the following language from Austin Energy’s solar program states (emphasis added):

Customers receiving service under either Non-Demand or Demand Value-Of-Solar Riders cannot combine services with the Load Shifting Voltage Discount Rider. Renewable Energy Credits (RECs) and all other renewable energy attributes for generation receiving Value-of-Solar credits are aggregated by Austin Energy. All RECs for energy consumed onsite will be retired on behalf of the solar customer.

This is a sample bilateral contract involving the Solano (CA) Community College District:

Environmental Attributes and Energy Credits. District shall own all right, title, and interest associated with or resulting from the development, construction, installation and ownership of any facilities installed on the Project (“Generating Facilities”).

Bibliography: Green-e Renewable Energy Standard for Canada and the United States, Version 3.2; March 20, 2018.
Austin Energy, FY 2019 ELECTRIC TARIFF, Value-Of-Solar Rider, Shared Solar Customer

Solano (CA) Community College District, AGREEMENT FOR DESIGN, INSTALLATION AND COMMISSIONING OF SOLAR/PHOTOVOLTAIC SYSTEM [http://www.solano.edu/measureq/1415/Energy%20Services%20Contract%20\(design-build%20form%20form%20use%20after%207%201%202012.pdf](http://www.solano.edu/measureq/1415/Energy%20Services%20Contract%20(design-build%20form%20form%20use%20after%207%201%202012.pdf)

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This proposal impacts who may claim the environmental attributes of an onsite-renewable energy system. The environmental attributes of the solar power have market value, reflected in RECs. The cost of installing solar panels may be reduced if the installer, leasing company or financial agent strips that value from the homeowner by taking possession or selling the RECs.

Public Comment# 2089

RE206-19

IECC: R401.2 (IRC N1101.13), R401.2.1 (IRC N1101.13.1) (New), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New), TABLE R407.2 (IRC N1107.2) (New)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with Section R401.2.1 and one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 (IRC N1101.13.1) Additional energy efficiency (Mandatory). This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one or more additional energy efficiency measures shall be installed in accordance with Section R407.2 that cumulatively equal or exceed 5 Flex Points.
2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following:
 - 2.1. One or more additional energy efficiency measures in Section R407.2 shall be installed that cumulatively equal or exceed five Flex Points, without including such measures in the proposed design under Section R405; or
 - 2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.
3. For buildings that comply under the energy rating index alternative in Section R406, the energy rating index value shall be at least 5 percent less than the energy rating index target specified in Table R406.4.

R407 (IRC N1107) **FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY**

R407.1 (IRC N1107.1) Scope. This section establishes flex point alternatives to achieve additional energy efficiency in accordance with Section R401.2.

R407.2 (IRC N1107.2) Flex Points for additional energy efficiency. Measures shall be selected from Table R407.2. Each measure chosen shall receive credit for the Flex Points as indicated in the Table for the specific Climate Zone. Interpolation of points between measures shall not be permitted.

**TABLE R407.2 (IRC N1107.2)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY**

Measure Number	Measure Description	Flex Point Value								
		Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C ^a	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
		1a	≥ 2.5% reduction in total UA ^b	1	1	2	2	2	2	3
1b	≥ 5% reduction in total UA ^b	3	3	3	3	3	4	5	5	5
1c	≥ 7.5% reduction in total UA ^b	5	5	5	5	5	6	7	8	8
2a	≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC	2	1	-	-	-	-	-	-	-
2b	≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC	4	1	-	-	-	-	-	-	-
3a	≤ 3 ACH50 air leakage rate with ERV or HRV installed ^c	2	4	5	7	7	7	7	8	8
3b	≤ 2 ACH50 air leakage rate with ERV or HRV installed ^c	2	5	7	9	9	9	10	11	11
4a	≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3.3	1	1	1	1	-	1	1	1	1
4b	100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the building thermal envelope or 100% of duct thermal distribution system located in conditioned space ^d	8	8	9	11	8	12	15	17	17
5a	≥ 18 SEER and ≥ 14 EER cooling system efficiency ^e	9	7	3	2	-	-	-	-	-
5b	≥ 16 EER cooling system efficiency ^e	10	7	3	2	-	-	-	-	-
6a	≥ 96 AFUE heating system efficiency ^f	-	2	6	9	10	10	11	12	14
7a	≥ 10.5 HSPF heating system efficiency ^f	-	1	2	4	4	5	4	3	3
7b	≥ 3.5 COP heating system efficiency ^f	-	2	4	6	6	8	7	6	5
8a	≥ 0.8 EF for fossil fuel service water heating system	7	5	4	3	2	2	2	1	1
8b	≥ 1.15 EF for electric service water heating system	7	7	7	4	5	3	3	2	2
8c	≥ 0.4 Solar Fraction for service water heating system	8	9	9	7	9	6	5	4	3

a. Climate Zone 4C is Climate Zone Marine 4.

b. The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.

c. Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).

d. As defined by Section R403.3.7.

e. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.

f. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

Reason: The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) by roughly 5% and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new “Flex Points” approach in Section R407 provides a multitude of options for builders to achieve the efficiency requirements of the IECC. This approach is also scalable according to a jurisdiction’s needs – states or localities who need additional energy savings to meet energy or climate policy goals can adjust the number of required points accordingly. Package- or points-based

approaches have been used for several years in Washington and Oregon. And since the 2012 IECC, the commercial provisions have included section C406 Additional Efficiency Package Options. We believe the updated approach in this proposal is a sensible means of achieving additional efficiency now and in the future.

This proposal is similar to the Flex Points proposal for the 2018 IECC in overall structure, but the points table has been simplified and updated based on feedback received in the previous Code Development Cycle. Like the previous version, this proposal also includes alternative compliance pathways for builders who select the simulated performance alternative or the Energy Rating Index, and will bring roughly equivalent improvements to all three compliance paths.

This Flex Points proposal is cost-effective, since it includes a number of options to achieve 5 points that are cost-effective.

The Flex Points proposal will provide three distinct benefits for jurisdictions adopting the 2021 IECC:

1. This proposal meets a clear need for efficiency improvements in the model energy code now and in the future.

Although the IECC has made small efficiency gains in the 2015 and 2018 editions, major gains have plateaued. Buildings still consume an estimated 42% of the nation's energy, 54% of its natural gas, and 71% of its electricity. Governors, legislators, and mayors are increasingly turning to building energy codes to meet energy and climate goals, and those codes should continue to provide reasonable improvements going forward. The U.S. Conference of Mayors, in its fourth consecutive resolution on the subject, reiterated their "concerted support for putting future triennial IECC updates on a "glide path" of steady efficiency gains that will improve the efficiency performance of millions of U.S. residential, multi-family, and commercial buildings." See 2018 U.S.C.M. Resolution 86 (June 11, 2018).

Several jurisdictions have already created or are in the process of creating package-based compliance paths or improved code provisions to meet their policy needs. The result is improved efficiency, but a lack of consistency in both format and requirements. Incorporating Flex Points into the 2021 IECC will not only provide a 5% boost in energy conservation but will also provide a realistic map for additional improvements going forward. And by providing more uniform targets for the efficiency of building components, this proposal will contribute to economies of scale, potentially lowering prices for builders and ultimately consumers.

2. This proposal will provide maximum flexibility for builders to achieve improved efficiency.

Flex Points trusts that builders and design professionals will select the most cost-effective and sensible efficiency improvements for a given project. There are several alternatives for compliance in each climate zone, along with options to comply in a performance- or rating-based path. There are alternatives related to more insulation, more efficient windows, reduced air and duct leakage and improved equipment. We believe that this approach provides the right incentives for builders to make long-lasting improvements in residential buildings that are in the best interests of homeowners.

The point values have been calculated based on the present value of energy cost savings over the current code (including relevant federal equipment efficiency standards) and reflect the estimated useful life of each measure over an assumed 30-year life of the building. While a 30-year period is consistent with the typical life of a mortgage, it is a very conservative period given the likelihood that some measures will provide efficiency benefits for decades beyond the initial 30-year period.

The analysis behind the flex points is based on the methodology and assumptions included in the U.S. Department of Energy's Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. The energy consumption calculations take into consideration heating, cooling, and water heating energy, using DOE-2 energy simulation across 105 TMY3 weather locations and 12 building types to account for varying stories, foundations, and fuel types for each of the baseline and upgrade measures. The analysis compares the annual energy savings between a home with and without an efficiency measure over the useful life of the efficiency measure using useful life data from NAHB and other sources. Energy costs were calculated using the most recent national EIA projections for natural gas and electricity. Because the analysis uses readily-available and widely-accepted tools and methodologies, we expect that future additions or changes will be straightforward.

3. This proposal will encourage efficiency improvements in building components that are currently difficult to regulate.

Flex Points addresses two issues that have complicated model energy codes for many years. First, innovative building practices or emerging technologies can benefit from being listed in codes, but states (and national code developing organizations) are reluctant to require new technologies or practices before they are market-tested. As a result, there are high barriers to entry for new technologies, even when they could transform the marketplace and provide energy- or cost-saving benefits for homeowners. As an example, Heat Recovery Ventilators (HRVs) are cost-effective and reasonable for much of the country, but individual circumstances or climate conditions may favor another approach. Rather than require HRVs in every case, or most cases with exceptions, HRVs and Energy Recovery Ventilators are included as one of several options available to builders in every climate zone. Not only will Flex Points create an opportunity for good technology to be used in more buildings, but it will open the door for market forces to make these technologies more widely available (and presumably less expensive to consumers). As new technologies or practices become available, these advances can be quickly and easily added into the Flex Points table, fast-tracking technology that is good for consumers.

Second, much of the heating, cooling, and water heating equipment installed in residential buildings is subject to federal preemption under the National Appliance Energy Conservation Act. As has been debated at length in ICC Code Development hearings over the last 15 years, including

equipment efficiencies in performance trade-offs tends to weaken the efficiency of the energy code, since federal minimum efficiencies for nearly every covered product is well below the efficiency levels of commonly installed products. When these efficiency levels are used in trade-off baselines, builders use the improved efficiency of common heating, cooling, and water heating products as a means of trading away efficiency of more permanent building components and features, even though the equipment would have been installed anyway. This "free ridership" may provide short-term cost savings for homebuilders, but it saddles homeowners with unexpected high energy costs over the entire useful life of the building. Moreover, this equipment often carries a much shorter useful life, which is not typically captured in code compliance simulations.

Flex Points creates a new incentive to improve the efficiency of covered products without resulting in efficiency rollbacks elsewhere in the code. Heating, cooling, and water heating improvements (among others) are included among the Flex Points options with points calculated according to climate-specific energy cost savings and the longevity of the equipment. As compared to the previous Flex Points proposal, the list of options has been simplified and refocused on the equipment most likely to provide meaningful energy savings. Each of these upgrades will build upon the current IECC efficiency, rather than trading it away.

In sum, we believe that this proposal will improve efficiency by roughly 5% while unlocking the competitive market for new technologies or building components that are difficult to regulate and will provide a useful new tool for policymakers across the country – all without rolling back the effectiveness or efficiency of the IECC.

Bibliography: *Uniting Cities to Accelerate Focus on the Economic and Climate Benefits of Boosting America's Building Energy Efficiency*, 2019 U.S.C.M. Resolution 86 (June 11, 2018), available at <https://www.usmayors.org/the-conference/resolutions/?category=c9211&meeting=86th%20Annual%20Meeting>.

Cost Impact: The code change proposal will increase the cost of construction. Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 5% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE206-19

Public Hearing Results

Errata: This proposal includes published errata
Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: No technical justification for the proposal, and the lack of public analysis does not allow future analysis and movement. Concerns with change of occupancy and lack of coordination between this and Chapter 5. Preference indicated for RE208 and RE209 (Vote: 8-3).

Assembly Action:

None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE206-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will provide a roughly 5% efficiency improvement to the IECC through a very flexible, points-based set of residential efficiency improvement options (builders can choose the best options for the specific

circumstances). RE206 also provides a mechanism for future updates to the code, either at the national or state level. A good number of cities, counties, and states have implemented improved energy conservation requirements beyond the 2018 IECC but these amendments tend to be developed independently of the national code update process, leading to a wide range of improvements across the country. RE206 will help standardize the process for achieving more efficiency, which will promote adoption and market transformation, producing economies of scale and reducing compliance costs, while also creating a framework for including other efficiency improvements going forward.

RE206 simultaneously improves all compliance paths of the code – prescriptive, performance, and ERI – helping ensure efficiency improvements in every home no matter which IECC compliance option is selected by the builder. RE206 encourages innovation and new technologies that would be more difficult to incorporate into the prescriptive path at this time. And it does so without cannibalizing the efficiency of the current IECC. RE206 also provides the opportunity to improve the efficiency of heating, cooling, and water heating equipment without weakening or trading off the base code requirements.

The two issues listed by the Committee for failing to approve the proposal are not persuasive:

Committee: *“No technical justification for the proposal and lack of public analysis does not allow future analysis and movement.”* To the contrary, technical justification and analysis has been provided in support of the proposal. Section 2 of the original reason provided for RE206 outlines the methodology used to calculate the energy savings and point values. The calculations are based on the methodology and assumptions used in the U.S. Department of Energy’s Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. For the complete DOE methodology, see <https://www.energycodes.gov/methodology-evaluating-cost-effectiveness-residential-energy-code-changes>. This methodology can be used in the future to revise or add measures to the Flex Points table. Thus, we believe the Committee’s concerns are misplaced.

Committee: *“Concerns with change of occupancy and lack of coordination between this and Chapter 5.”* Concerns regarding Chapter 5 do not justify rejecting this proposal. Chapter 5 only applies the requirements of the IECC specifically listed in that chapter to existing buildings. If a requirement is not specified in Chapter 5, that requirement does not apply to the existing building. Thus, because Chapter 5 does not specify new section R401.2.1 (Additional energy efficiency) or Section R407, this new requirement would not apply to existing buildings (either through change of occupancy or for additions, alterations or repairs). We see no need to complicate RE206 with changes to Chapter 5 if the end result is the same -- that the new provisions would not apply to existing buildings anyway. If there is some desire to apply the provisions of Section R407 to existing buildings, that can be accomplished in a future code change. Concerns about existing buildings should not derail the clear improvements for new buildings that would result from this proposal.

In sum, we believe RE206 will not only result in a meaningful improvement in efficiency without rolling back any of the 2018 IECC’s provisions, but will also provide a framework for states and local jurisdictions to apply a more consistent set of improvements in building efficiency. It will also pave the way for future improvements to the IECC and will create space for new technologies and building methods that would be difficult to include at this point as standalone requirements in the current code.

Bibliography: <https://www.energycodes.gov/methodology-evaluating-cost-effectiveness-residential-energy-code-changes>

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated in the original proposal, requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 5% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1511

RE207-19

IECC: R401.2 (IRC N1101.13.1), R401.2.1 (IRC N1101.13.1) (New), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New), TABLE R407.2 (IRC N1107.2) (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with Section R401.2.1 one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 (IRC N1101.13.1) Additional Energy Efficiency (Mandatory) This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one or more additional energy efficiency measure(s) shall be installed in accordance with Section R407.2 that cumulatively equal or exceed 10 (ten) Flex Points.
2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following: (a) one or more additional energy efficiency measure(s) in Section R407.2 shall be installed that cumulatively equal or exceed ten Flex Points, without including such measures in the proposed design under Section R405; or (b) the proposed design of the building under section R405.2 shall have an annual energy cost that is less than or equal to 90% of the annual energy cost of the *standard reference design*.
3. For buildings that comply under the energy rating index alternative in Section R406, the energy rating index value shall be at least 10% less than the energy rating index target specified in Table R406.4.

SECTION R407 (IRC N1107) **FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY**

R407.1 (IRC N1107.1) Scope. This section establishes flex point alternatives to achieve additional energy efficiency in accordance with Section R401.2.1.

R407.2 (IRC N1107.2) Flex points for additional energy efficiency Measures shall be selected from Table R407.2.1. Each measure chosen shall receive credit for the Flex Points as indicated in the Table for the specific Climate Zone. Interpolation of points between measures shall not be permitted.

**TABLE R407.2 (IRC N1107.2)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY**

Measure Number	Measure Description	Flex Point Value								
		CZ 1	CZ 2	CZ 3	CZ 4	CZ 4C _a	CZ 5	CZ 6	CZ 7	CZ 8
1a	≥ 2.5% reduction in total UA ^b	1	1	2	2	2	2	3	4	4
1b	≥ 5% reduction in total UA ^b	3	3	3	3	3	4	5	5	5
1c	≥ 7.5% reduction in total UA ^b	5	5	5	5	5	6	7	8	8
2a	≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC	2	1	-	-	-	-	-	-	-
2b	≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC	4	1	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
3a	≤ 3 ACH50 air leakage rate with ERV or HRV installed ^c	2	4	5	7	7	7	7	8	8
3b	≤ 2 ACH50 air leakage rate with ERV or HRV installed ^c	2	5	7	9	9	9	10	11	11
-	-	-	-	-	-	-	-	-	-	-
4a	≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3	1	1	1	1	-	1	1	1	1
4c	100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the <i>building thermal envelope</i> or 100% of duct thermal distribution system located in <i>conditioned space</i> ^d	8	8	9	11	8	12	15	17	17
5a	≥ 18 SEER and ≥ 14 EER cooling system efficiency ^e	9	7	3	2	-	-	-	-	-
5b	≥ 16 EER cooling system efficiency ^e	10	7	3	2	-	-	-	-	-
6a	≥ 96 AFUE heating system efficiency ^f	-	2	6	9	10	10	11	12	14
7a	≥ 10.5 HSPF heating system efficiency ^f	-	1	2	4	4	5	4	3	3
7b	≥ 3.5 COP heating system efficiency ^f	-	2	4	6	6	8	7	6	5
-	-	-	-	-	-	-	-	-	-	-
8a	≥ 0.8 EF for fossil fuel service water heating system	7	5	4	3	2	2	2	1	1
8b	≥ 1.15 EF for electric service water heating system	7	7	7	4	5	3	3	2	2
8c	≥ 0.4 Solar Fraction for service water heating system	8	9	9	7	9	6	5	4	3

a. Climate Zone 4C is Climate Zone Marine 4.

b. The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.

c. Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).

d. As defined by Section R403.3.7.

e. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.

f. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

Reason: This proposal, submitted by the Northwest Energy Codes Group, provides an alternative to the Flex Point proposal submitted by the Energy Efficient Codes Coalition by requiring ten flex points for an efficiency increase of ten (10) percent over the base prescriptive codes. The Northwest pioneered the use of the prescriptive residential options that are currently in place in Washington, and formally were used in Oregon, and found them to be an effective method of increasing efficiency for residential construction using the prescriptive approach. This option does not require performance energy modeling or HERS verification which will increase its usefulness. This type of points based option can also be easily implemented in the U.S. DOE REScheck software. This approach is also similar in structure to the Points Option code change proposal that has

been submitted by the Northwest Energy Codes Group to C407 in the commercial provisions of the 2018 IECC. This proposal will provide more consistency between the IECC and the Washington State Residential Energy Code which is based on the IECC.

The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) by roughly 10% and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new “Flex Points” approach in Section R407 provides a multitude of options for builders to achieve the efficiency requirements of the IECC. This approach is also scalable according to a jurisdiction’s needs – states or localities who need additional energy savings to meet energy or climate policy goals can adjust the number of required points accordingly. Package- or points-based approaches have been used for several years in Washington and Oregon.

This proposal is similar to the Flex Points proposal for the 2018 IECC in overall structure, but the points table has been simplified and updated based on feedback received in the previous Code Development Cycle. Like the previous version, this proposal also includes alternative compliance pathways for builders who select the simulated performance alternative or the Energy Rating Index, and will bring roughly equivalent improvements to all three compliance paths.

This Flex Points proposal is cost-effective, since it includes a number of options to achieve 10 points that are cost-effective.

The Flex Points proposal will provide three distinct benefits for jurisdictions adopting the 2021 IECC:

1. This proposal meets a clear need for efficiency improvements in the model energy code now and in the future.

Although the IECC has made small efficiency gains in the 2015 and 2018 editions, major gains have plateaued. Buildings still consume an estimated 42% of the nation’s energy, 54% of its natural gas, and 71% of its electricity. Governors, legislators, and mayors are increasingly turning to building energy codes to meet energy and climate goals, and those codes should continue to provide reasonable improvements going forward. The U.S. Conference of Mayors, in its fourth consecutive resolution on the subject, reiterated their “concerted support for putting future triennial IECC updates on a “glide path” of steady efficiency gains that will improve the efficiency performance of millions of U.S. residential, multi-family, and commercial buildings.” See 2018 U.S.C.M. Resolution 86 (June 11, 2018).

Several jurisdictions have already created or are in the process of creating package-based compliance paths or improved code provisions to meet their policy needs. The result is improved efficiency, but a lack of consistency in both format and requirements. Incorporating Flex Points into the 2021 IECC will not only provide a 10% boost in energy conservation but will also provide a realistic map for additional improvements going forward. And, by providing more uniform targets for the efficiency of building components, this proposal will contribute to economies of scale, potentially lowering prices for builders and ultimately consumers.

2. This proposal will provide maximum flexibility for builders to achieve improved efficiency.

Flex Points trusts that builders and design professionals will select the most cost-effective and sensible efficiency improvements for a given project. There are several alternatives for compliance in each climate zone, along with options to comply in a performance- or rating-based path. There are alternatives related to more insulation, more efficient windows, reduced air and duct leakage and improved equipment. We believe that this approach provides the right incentives for builders to make long-lasting improvements in residential buildings that are in the best interests of homeowners.

The point values have been calculated based on the present value of energy cost savings over the current code (including relevant federal equipment efficiency standards) and reflect the estimated useful life of each measure over an assumed 30-year life of the building. While a 30-year period is consistent with the typical life of a mortgage, it is a very conservative period given the likelihood that some measures will provide efficiency benefits for decades beyond the initial 30-year period.

The analysis behind the flex points is based on the methodology and assumptions included in the U.S. Department of Energy’s Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. The energy consumption calculations take into consideration heating, cooling, and water heating energy, using DOE-2 energy simulation across 105 TMY3 weather locations and 12 building types to account for varying stories, foundations, and fuel types for each of the baseline and upgrade measures. The analysis compares the annual energy savings between a home with and without an efficiency measure over the useful life of the efficiency measure using useful life data from NAHB and other sources. Energy costs were calculated using the most recent national EIA projections for natural gas and electricity. Because the analysis uses readily-available and widely-accepted tools and methodologies, we expect that future additions or changes will be straightforward.

3. This proposal will encourage efficiency improvements in building components that are currently difficult to regulate.

Flex Points addresses two issues that have complicated model energy codes for many years. First, innovative building practices or emerging technologies can benefit from being listed in codes, but states (and national code developing organizations) are reluctant to require new technologies or practices before they are market-tested. As a result, there are high barriers to entry for new technologies, even when they could transform the marketplace and provide energy- or cost-saving benefits for homeowners. As an example, Heat Recovery Ventilators (HRVs) are cost-effective and reasonable for much of the country, but individual circumstances or climate conditions may favor another approach. Rather than require HRVs in every case, or most cases with exceptions, HRVs and Energy Recovery Ventilators are included as one of several options available to builders in

every climate zone. Not only will Flex Points create an opportunity for good technology to be used in more buildings, but it will open the door for market forces to make these technologies more widely available (and presumably less expensive to consumers). As new technologies or practices become available, these advances can be quickly and easily added into the Flex Points table, fast-tracking technology that is good for consumers.

Second, much of the heating, cooling, and water heating equipment installed in residential buildings is subject to federal preemption under the National Appliance Energy Conservation Act. As has been debated at length in ICC Code Development hearings over the last 15 years, including equipment efficiencies in performance trade-offs tends to weaken the efficiency of the energy code, since federal minimum efficiencies for nearly every covered product is well below the efficiency levels of commonly installed products. When these efficiency levels are used in trade-off baselines, builders use the improved efficiency of common heating, cooling, and water heating products as a means of trading away efficiency of more permanent building components and features, even though the equipment would have been installed anyway. This “free ridership” may provide short-term cost savings for homebuilders, but it saddles homeowners with unexpected high energy costs over the entire useful life of the building. Moreover, this equipment often carries a much shorter useful life, which is not typically captured in code compliance simulations.

Flex Points creates a new incentive to improve the efficiency of covered products without resulting in efficiency rollbacks elsewhere in the code. Heating, cooling, and water heating improvements (among others) are included among the Flex Points options with points calculated according to climate-specific energy cost savings and the longevity of the equipment. As compared to the previous Flex Points proposal, the list of options has been simplified and refocused on the equipment most likely to provide meaningful energy savings. Each of these upgrades will build upon the current IECC efficiency, rather than trading it away.

In sum, we believe that this proposal will improve efficiency by roughly 10% while unlocking the competitive market for new technologies or building components that are difficult to regulate and will provide a useful new tool for policymakers across the country – all without rolling back the effectiveness or efficiency of the IECC.

Bibliography: *Uniting Cities to Accelerate Focus on the Economic and Climate Benefits of Boosting America's Building Energy Efficiency*, 2019 U.S.C.M. Resolution 86 (June 11, 2018), available at <https://www.usmayors.org/the-conference/resolutions/?category=c9211&meeting=86th%20Annual%20Meeting>.

Cost Impact: The code change proposal will increase the cost of construction. The code change proposal will increase the cost of construction. Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 10% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE207-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent requested disapproval as an opportunity to provide greater transparency of analysis and work with opponents to resolve issues (Vote: 11-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE207-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.2.1 (IRC N1101.13.1) (New), TABLE R407.2 (IRC N1107.2) (New)

Proponents:

Eric Makela, representing Northwest Energy Codes Group (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.2.1 (IRC N1101.13.1) Additional Energy Efficiency (Mandatory) This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one or more additional energy efficiency measures shall be installed in accordance with Section R407.2 that cumulatively equal or exceed ~~10~~ 5 (~~ten~~ five) Flex Points.
2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following:
 - 2.1. One or more additional energy efficiency measures in Section R407.2 shall be installed that cumulatively equal or exceed ~~ten~~ five Flex Points, without including such measures in the proposed design under Section R405; or
 - 2.2. The proposed design of the building under section R405.2 shall have an annual energy cost that is less than or equal to ~~90~~ 95 percent of the annual energy cost of the *standard reference design*.
3. For buildings that comply under the energy rating index alternative in Section R406, the energy rating index value shall be at least ~~10~~ 5 percent less than the energy rating index target specified in Table R406.4.

**TABLE R407.2 (IRC N1107.2)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY**

Measure Number	Measure Description	Flex Point Value								
		CZ 1	CZ 2	CZ 3	CZ 4	CZ 4C _a	CZ 5	CZ 6	CZ 7	CZ 8
1a	≥ 2.5% reduction in total UA ^b	1	1	2	2	2	2	3	4	4
1b	≥ 5% reduction in total UA ^b	3	3	3	3	3	4	5	5	5
1c	≥ 7.5% reduction in total UA ^b	5	5	5	5	5	6	7	8	8
2a	≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC	2	1	-	-	-	-	-	-	-
2b	≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC	4	1	-	-	-	-	-	-	-
3a	≤ 3 ACH50 air leakage rate with ERV or HRV installed ^c	2	4	5	7	7	7	7	8	8
3b	≤ 2 ACH50 air leakage rate with ERV or HRV installed ^c	2	5	7	9	9	9	10	11	11
4a	≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3	1	1	1	1	-	1	1	1	1
4c	100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the <i>building thermal envelope</i> or 100% of duct thermal distribution system located in <i>conditioned space</i> ^d	8	8	9	11	8	12	15	17	17
5a	≥ 18 SEER and ≥ 14 EER cooling system efficiency ^e	9	7	3	2	-	-	-	-	-
5b	≥ 16 EER cooling system efficiency ^e	10	7	3	2	-	-	-	-	-
6a	≥ 96 AFUE heating system efficiency ^f	-	2	6	9	10	10	11	12	14
7a	≥ 10.5 HSPF heating system efficiency ^f	-	1	2	4	4	5	4	3	3
7b	≥ 3.5 COP heating system efficiency ^f	-	2	4	6	6	8	7	6	5
8a	≥ 0.8 EF for fossil fuel service water heating system	7	5	4	3	2	2	2	1	1
8b	≥ 1.15 EF for electric service water heating system	7	7	7	4	5	3	3	2	2
8c	≥ 0.4 Solar Fraction for service water heating system	8	9	9	7	9	6	5	4	3
9a	≥ 1 kW of photovoltaic or wind power ^g	1	1	1	1	1	1	1	1	1

a. Climate Zone 4C is Climate Zone Marine 4.

b. The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.

c. Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).

d. As defined by Section R403.3.7.

e. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.

f. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

g. For each 1 kW of electrical generation per housing unit provided by on-site wind or solar equipment a 1.0 Flexpoint shall be allowed, up to 2 Flexpoints. Generation/capacity shall be calculated as follows: For solar electric systems, the design shall be demonstrated to meet this requirement using the analysis approved by the code official. Documentation of solar access shall be included on the plans. For wind generation projects designs shall document annual power generation based on the following factors: The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower.

Commenter's Reason: The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) by roughly 5% and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new "Flex Points" approach in Section R407 provides a multitude of options

for builders to achieve the efficiency requirements of the IECC.

This Public Comment modifies RE 207 by reducing the number of points required to meet the requirements from 10 to 5 and by adding the ability to take credit for installing onsite solar or wind energy. This Public Comment also brings RE207 in line with the C406 Points Options proposal and the Washington State Residential Energy Code.

Reduction in Points

RE 207 originally required the code user to select Flexpoints that was equivalent to a 10% increase in efficiency over the prescriptive requirements in the code. A parallel proposal was also submitted into the commercial provisions of the IECC (CE 218) that provides for a Points Option for the prescriptive requirement of the code. This proposal requires the code user to select 10 credits that represent a 2.5% increase in efficiency. This Public Comment would require a 5% increase in efficiency which is easily achieved through modest increases in efficiency by selecting features from several options. Reducing the point requirement to 5% also brings this in line with states like Washington.

Addition of Renewable for Renewables

The Public Comment allows up to two Flexpoints to be selected for the installation of onsite solar or wind generation. The Flexpoint table will require at least one kW of onsite generation to be installed if this option is selected. The point values were selected based on a Northwest Energy Efficiency Alliance analysis for the Oregon Energy Code and also language New Buildings Institute proposed for New York Stretch Code. The threshold of renewable installation of 1 kW is also consistent with the WA Residential Energy Code that requires 1.2 kW of installation and also the level proposed by New Buildings Institute for the New York Stretch Code. Adding a renewable credit is also consistent with the renewable allowance that has been in the C406 Options Packages that was incorporated into the IECC in 2012. Adding a renewable component to the Flexpoint table will increase the flexibility of the table and also allow builders who install renewable systems to take credit.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The code change proposal will increase the cost of construction. Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 5% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 2036

RE208-19

IECC: R401.2 (IRC N1101.13), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), Table R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New)

Proposed Change as Submitted

Proponents: Amanda Hickman, The Hickman Group, representing The Leading Builders of America (LBA) (amanda@thehickmangroup.com)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404 and Section R407.
2. Section R405, Section R407 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R407 (IRC N1107) ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS

R407.1 (IRC N1107.1) Scope. This section establishes options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code* to demonstrate compliance with this code.

Exception: These requirements shall not apply to:

1. Homes complying under the Energy Rating Index (R406)
2. Alternations, renovations and repairs to an existing building
3. Additions with a conditioned floor area of less than 1,200 square feet.

R407.2 (IRC N1107.2) Requirements In order to comply with this code:

1. Building utilizing the prescriptive path to comply with this code shall also comply with sufficient energy efficiency options from Table R407.1 in order to achieve a minimum of 3 energy credits.
2. Building utilizing the performance path to comply with this code shall use an adjusted annual energy cost that is 97% of the annual energy cost of the *standard reference design* when calculating Performance-based compliance (R405.3).

**Table R407.1 (IRC N1107.1)
ENERGY EFFICIENCY MEASURES**

-	-	Climate Zone	1	2	3	4	5	6	7,8
CATEGORY	OPT	DESCRIPTION	CREDITS						
1	a	Attic Insulation R-38	0.5	-	-	-	-	-	-
1	b	Attic Insulation R-49	0.5	0.5	1	-	-	-	-
1	c	Attic Insulation R-60	1	1	1	0.5	0.5	0.5	0.5
1	d	Attic Insulation R-71	1	1	1.5	1	1	1	1
2	a	Wall Insulation (16 o.c.) R-15	0.5	0.5	-	-	-	-	-
2	b	Wall Insulation (16 o.c.) R-13+3	2	2.5	-	-	-	-	-
2	c	Wall Insulation (16 o.c.) R-20	2.5	3.5	-	-	-	-	-
2	d	Wall Insulation (16 o.c.) R-21	2.5	3.5	-	-	-	-	-
2	e	Wall Insulation (16 o.c.) R-13+5	2.5	3.5	-	-	-	-	-
2	f	Wall Insulation (16 o.c.) R-15+5	2.5	3.5	1	1	1	-	-
2	g	Wall Insulation (16 o.c.) R-23 BIB	3	3.5	-	-	-	-	-
2	h	Wall Insulation (16 o.c.) R-13+10	3	3.5	3	3	3	-	-
2	i	Wall Insulation (16 o.c.) R-20+5	3	3.5	3	2.5	3	-	-
2	j	Wall Insulation (16 o.c.) R-15+10	3	3.5	3.5	3	3.5	0.5	0.5
2	k	Wall Insulation (16 o.c.) R-20+10	3	3.5	3.5	3	4.5	1.5	1.5
2	l	Wall Insulation (24 o.c.) R-20	3	3.5	0.5	0.5	-	-	-
2	m	Wall Insulation (24 o.c.) R-21	3	3.5	0.5	0.5	1	-	-
2	n	Wall Insulation (24 o.c.) R-23 BIB	3	4	1.5	1	1	-	-
2	o	Wall Insulation (24 o.c.) R-20+5	3	4	3	3	3	0.5	0.5
2	p	Wall Insulation (24 o.c.) R-20+10	3	4	3	4.5	4.5	2	2
2	q	Wall Insulation (24 o.c.) R-30+10	3	4	3	4.5	4.5	3	3.5
3	a	Mass Wall R-6 c.i.	2	-	-	-	-	-	-
3	b	Mass Wall (16 o.c.) R-13	4.5	3	-	-	-	-	-
3	c	Mass Wall (16 o.c.) R-20	4.5	6	-	-	-	-	-
3	d	Mass Wall R-12 c.i.	6	5.5	-	-	-	-	-
4	a	Basement Wall R-5 ci	-	-	-	-	-	-	-
4	b	Basement Wall R-10 ci	-	-	3.5	-	-	-	-
4	c	Basement Wall R-13	-	-	4	0.5	-	-	-
4	d	Basement Wall R-15	-	-	5	2	-	-	-
4	e	Basement Wall R-19	-	-	5	2	-	0.5	0.5
4	f	Basement Wall R-20	-	-	5.5	2.5	0.5	0.5	0.5
4	g	Basement Wall R-21	-	-	5.5	2.5	0.5	1	1
4	h	Basement Wall R-23 BIB	-	-	5.5	3	1	1.5	1.5
4	i	Basement Wall R-30 ccSPF	-	-	6.5	4	2	2.5	2.5
5	a	Slab Edge R-10, 2 ft depth	0.5	1.5	2.5	-	-	-	-
5	b	Slab Edge R-10, 4 ft depth	0.5	2	3.5	1	1	-	-
5	c	Slab Edge R-15, 4 ft depth	1	2	0.5	1.5	1.5	0.5	0.5
6	a	Windows U-0.40, SHGC-0.25	0.5	-	-	-	-	-	-
6	b	Windows U-0.32, SHGC-0.25	1.5	1.5	-	-	-	-	-
6	c	Windows U-0.30, SHGC-0.25	(1.5)	2	0.5	-	-	-	-
6	d	Windows U-0.27, SHGC-0.25	-	-	1.5	-	-	-	-
6	e	Windows U-0.30, SHGC-0.40	-	-	-	0.5	-	-	-

-	-	Climate Zone	1	2	3	4	5	6	7.8
CATEGORY	OPT	DESCRIPTION	CREDITS						
6	f	Windows U-0.27, SHGC-0.40	-	-	-	2	1.5	1.5	1.5
6	g	Windows U-0.23, SHGC-0.40	-	-	-	3.5	3	4	4
6	h	Windows U-0.18, SHGC-0.40	-	-	-	5.5	5	6.5	7
6	i	Windows U-0.12, SHGC-0.40	-	-	-	8	8	10	10.5
7	a	Tightness- 4 ACH50	0.5	0.5	-	-	-	-	-
7	b	Tightness- 3 ACH50	0.5	1.5	-	-	-	-	-
7	c	Tightness- 2 ACH50	-	-	1.5	2.5	3.5	3	4.5
7	d	Tightness- 1.5 ACH50	-	-	2	3.5	5	4.5	6.5
7	e	Tightness- 0.6 ACH50	-	-	3	5	6.5	6.5	9
8	a	Ducts in Attic: Reduced Leakage $\leq 2\text{cfm}/100@25^{\text{l}}$	2	2.5	2	1.5	2	2	2
8	b	Compact Layout: duct surface area $\leq 15\%$ of conditioned floor area for supply ducts and $\leq 4\%$ for return ducts	0.5	0.5	0.5	0.5	1	1	1
8	c	Compact Layout + Reduced Leakage	2.8	2.5	2.5	2.5	3	3	3
8	d	Deeply Buried Ducts, in accordance with 2018 IECC section R403.3.6.1	1	1.5	1.5	1.5	2	2.5	2.5
8	e	Compact Layout + Deeply Buried	1	1.5	2	2	2.5	3	3
8	f	Compact + Deeply Buried Ducts + Reduced Leakage	3.5	3.5	4	3.5	4.5	4.5	4.5
8	g	Ducts 100% Inside Conditioned Space	6.5	6.5	7.5	7.5	9	9	9
9	a	Radiant Barrier- Roof Deck ^k	0.5	0.5	-	-	-	-	-
10	a	Furnace or Boiler- 92 AFUE, PSC	-	1	3	4	4.5	5	6
10	b	Furnace or Boiler- 92 AFUE, ECM	-	1	3.5	4.5	5	5.5	7
10	c	Furnace or Boiler- 95 AFUE, ECM	0.5	1.5	4.5	5.5	6	7	8
10	d	Furnace or Boiler- 96 AFUE, ECM	0.5	1.5	5	5.5	6.5	7	8
10	e	Furnace or Boiler- 97 AFUE, ECM	0.5	1.5	5	6	7	7.5	9
11	a	Air Conditioner 14 SEER	-	-	-	-	0.5	0.5	-
11	b	Air Conditioner 15 SEER	2	2.5	0.5	0.5	1	0.5	-
11	c	Air Conditioner 16 SEER	4	4	1.5	1	1	0.5	0.5
11	d	Air Conditioner 18 SEER	7	6.5	2.5	1.5	-	-	-
11	e	Air Conditioner 19 SEER	8	7.5	3	2	-	-	-
11	f	Air Conditioner 20 SEER	9.5	8.5	3.5	2.5	-	-	-
11	g	Air Conditioner 24 SEER	13	11.5	5	3	-	-	-
12	a	Heat Pump 15 SEER/8.5 HSPF	2	3	1.5	1.5	1	0.5	2
12	b	Heat Pump 16 SEER/9 HSPF	4	5	3.5	3	3	2	2
12	c	Heat Pump 18 SEER/10 HSPF	7.5	8.5	7	6.5	6	5	5
12	d	Heat Pump 20 SEER/10 HSPF	10	10.5	7.5	7	6.5	5	5
12	e	Heat Pump 24 SEER/10 HSPF	13.5	13.5	9	7.5	7	5.5	5.5
13	a	Energy Star Gas, 40 gal, med draw, 0.65 UEF/0.64 EF	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13	b	Gas instantaneous, 0.81 UEF/EF	2	2	2	1.5	1	1	1
13	c	Energy Star Gas instantaneous, 0.87 UEF/EF	2	2	2	1.5	1.5	1.5	1.5
13	d	High Eff Gas instantaneous, 0.9 UEF/EF	2.5	2	2	2	1.5	1.5	1.5
13	e	Energy Star elec heat pump, 50 gal, 2.0 UEF/1.82 EF	4	5	6	5.5	5	5	4
13	f	High Eff elec heat pump, 50 gal, 3.1 UEF/3.2 EF	5.5	7	8.5	8	7	7	6

-	-	Climate Zone	1	2	3	4	5	6	7.8
CATEGORY	OPT	DESCRIPTION	CREDITS						
14	a	LED 95% interior, exterior, garage	2.5	2.5	2.5	2.5	2.5	2.5	2.5

-
- a. Only one item in each Category can be counted.
- b. CZ4 includes Climate Zone 4 except Climate Zone 4 Marine.
- c. CZ5 includes Climate Zone 5 and Climate Zone 4 Marine.
- d. R-values are minimum averages.
- e. U-factors and SHGC are maximum weighted averages (exception: SHGC permitted to be higher in climate zones 5-8).
- f. Building tightness and duct tightness are maximum.
- g. Effectiveness, AFUE, SEER, HSPF, EF are minimums.
- h. Cells containing a dash (-), indicate zero credits because that measure is the baseline requirement or was not shown to improve energy savings.
- i. For any measure where the installed efficiency value falls between two thresholds from the table, credit shall be taken for the highest threshold that the installed value meets or exceeds.
- j. Measured leakage is outside conditioned space.
- k. Radiant Barriers shall comply with with IBC Section 1509 and shall be installed over the entire roof deck over conditioned space.

Revise as follows:

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass, where the proposed wall is a mass wall; otherwise, wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft ² per 300 ft ² of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft ² .	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified Table R402.1.4.	As proposed
Vertical fenestration other than opaque doors	Total area ^h = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
	SHGC: as specified in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design).	Interior shade fraction: 0.92-(0.21 × SHGC as proposed)
	External shading: none.	As proposed
Skylights	None.	As proposed
Thermally isolated sunrooms	None.	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 1 and 2: 5 air changes per hour. Climate Zones 3 through	The measured air exchange rate. ^a The mechanical ventilation rate ^b shall be in addition to

Air exchange rate	<p>Climate Zones 1 and 2: 3 air changes per hour. Climate Zones 3 through 8: 3 air changes per hour.</p> <p>The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$</p> <p>where:</p> <p>CFA = conditioned floor area, ft².</p> <p>N_{br} = number of bedrooms.</p> <p>Energy recovery shall not be assumed for mechanical ventilation.</p>	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	<p>Where mechanical ventilation is not specified in the proposed design: None</p> <p>Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal:</p> $(Ue_f) \times [0.0876 \times CFA + 65.7 \times (N_{br} + 1)]$ <p>where:</p> <p>e_f = the minimum exhaust fan efficacy, as specified in Table R403.6.1, corresponding to a flow rate of $0.01 \times CFA + 7.5 \times (N_{br} + 1)$</p> <p>CFA = conditioned floor area, ft².</p> <p>N_{br} = number of bedrooms.</p>	As proposed
Internal gains	<p>IGain, in units of Btu/day per dwelling unit, shall equal: $17,900 + 23.8 \times CFA + 4,104 \times N_{br}$</p> <p>where:</p> <p>CFA = conditioned floor area, ft².</p> <p>N_{br} = number of bedrooms.</p>	Same as standard reference design.
Internal mass	Internal mass for furniture and contents: 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element ^c but not integral to the building envelope or structure.
Structural mass	For masonry floor slabs: 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.	As proposed
	For masonry basement walls: as proposed, but with insulation as specified in Table R402.1.4, located on the interior side of the walls.	As proposed
	For other walls, ceilings, floors, and interior walls: wood frame construction.	As proposed
Heating systems ^{d, e}	<p>For other than electric heating without a heat pump: as proposed.</p> <p>Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section G403 of the IECC—Commercial Provisions.</p> <p>Capacity: sized in accordance with Section R403.7.</p> <p><u>Fuel Type/Capacity: Same as proposed design.</u></p> <p><u>Efficiencies:</u></p> <p><u>Electric: air source heat pump complying with prevailing federal minimum standards.</u></p> <p><u>Nonelectric furnaces: natural gas furnace complying with prevailing federal minimum standards</u></p> <p><u>Nonelectric boilers: natural gas boiler complying with prevailing federal minimum efficiencies</u></p>	<p>As proposed</p> <p><u>As proposed</u></p> <p><u>As proposed</u></p> <p><u>As proposed</u></p> <p><u>As proposed</u></p>

Cooling systems ^{d, f}	<p><u>As proposed. Capacity: sized in accordance with Section R403.7.</u></p> <p><u>Fuel Type/Capacity: Same as proposed design</u></p> <p><u>Efficiency: complying with federal minimum standards</u></p>	<p><u>As proposed</u></p> <p><u>As proposed</u></p> <p><u>As proposed</u></p>
Service water heating ^{d, e, f, g}	<p><u>As proposed. Use: same as proposed design.</u></p> <p><u>Fuel type: Same as proposed design</u></p> <p><u>Efficiency: complying with prevailing federal minimum standards</u></p> <p><u>Use: gal/day = 30 + 10 x Nbr</u></p> <p><u>Tank temperature: 120° F</u></p>	<p><u>As proposed</u></p> <p><u>Use, in units of gal/day = 30 + (10 × N_{br})</u></p> <p><u>where:</u></p> <p><u>N_{br} = number of bedrooms.</u></p> <p><u>As proposed</u></p> <p><u>As proposed</u></p> <p><u>Same as standard reference</u></p> <p><u>Same as standard reference</u></p>
Thermal distribution systems	<p>Duct insulation: in accordance with Section R403.3.1.</p> <p>A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems.</p> <p>Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.</p> <p>For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).</p>	<p>Duct insulation: as proposed.</p> <p>As tested or, where not tested, as specified in Table R405.5.2(2)</p>
Thermostat	<p>Type: Manual, cooling temperature setpoint = 75° F; heating temperature setpoint = 72° F.</p>	<p>Same as standard reference design.</p>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

- a. Where required by the *code official*, testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals*, page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.
- c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
- h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

$$AF = A_s \times FA \times F$$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

L and CFA are in the same units.

Reason: This proposal introduces a new section within the code that will require additional efficiency measures (options) for residential buildings. When taking the prescriptive approach, options from the table with assigned credit values must be selected in order to achieve 3 credits. For the performance approach, the same number of percentage number will reduce the annual energy cost for the standard reference design. The ERI path has not been included in this proposal as it is currently the most stringent path in the code.

The energy efficiency measures listed in Table 407.1 were analyzed using Ekotrope Rater modeling software (v3.1.0) to estimate energy savings relative to a 2018 IECC prescriptive reference house baseline. The energy modeling was performed by Home Innovation Research Labs. For all building characteristics not defined in the IECC, the "Methodology for Calculating Energy Use in Residential Buildings" was followed. This Methodology was developed in 2012 by Home Innovation Research Labs (formerly NAHB Research Center) to provide guidance, uniformity, and practical construction and equipment choices for researchers comparing the energy performance differences resulting from potential code changes.

A two-story single-family house (2,352 square feet above grade) was analyzed in 9 different locations across climate zones 1 through 7. For each location, multiple house configurations were analyzed to capture the effects of regionally-typical foundations and wall construction types. An all-electric house and a house with gas space heating and gas water heating were analyzed, resulting in 48 baseline designs for each of these configurations. Climate-appropriate energy conservation measures (ECMs) were analyzed individually for each unique house configuration for each location, resulting in more than 2,200 discrete designs covering all major aspects of building envelope construction, air tightness, equipment efficiencies and lighting and appliances. The credits in Table 407.1 were assigned as the weighted averages of the estimated whole-building energy savings (%) for each house configuration for the location. The weighting was based on regional market data. The credits are the result of weighted average whole-building energy savings rounded down to a 0.5% increment; except where the total energy savings ranged between 0.4% and 0.5%, the values were rounded up to 0.5%.

In addition to individual measures, select packages of measures were also simulated for analysis across several climate zones. The comparison of additive energy savings from individual measures and the modeled net savings from packages of the same measures indicated that at the proposed 3% incremental levels of improvement, a simple addition of energy savings from individual measures is an adequate representation of their combined efficiency.

The energy performance target of 3% (or 3 credits) represents an incremental level of improvement that can be achieved through one or more compliance options (individual measures or a combination of measures) that meet the cost effectiveness metrics of simple payback of 10-15 years depending on the type of the measure.

The required credits and the paths to achieve these efficiency gains have been determined using current cost data provided by homebuilders from across the U.S. to have at a minimum a 10-year simple payback and to be cost effective when using the life cycle analysis method.

Cost Impact: The code change proposal will increase the cost of construction

This proposal will increase the cost of construction. However, it has been determined, using current homebuilder cost data, that this proposal provides paths with at least a 10-year (or better) simple payback. This proposal has also been determined to be cost effective using the life cycle analysis method.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This is not a mechanism to move forward, it is missing renewables, and cost justification is imperative, there are additional questions on values and equipment tradeoffs (Vote: 7-4).

Assembly Action:

None

RE208-19

Individual Consideration Agenda

Public Comment 1:

IECC®: Table R407.1 (IRC N1107.1) (New), TABLE R405.5.2(1) [IRC N1105.5.2(1)], R407.1 (IRC N1107.1) (New)

Proponents:

Amanda Hickman, representing The Leading Builders of America (LBA) (amanda@thehickmangroup.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**Table R407.1 (IRC N1107.1)
ENERGY EFFICIENCY MEASURES**

Portions of table not shown remain unchanged.

		Climate Zone	1	2	3	4	5	6	7,8
CATEGORY	OPT	DESCRIPTION	CREDITS						
2	g	Wall Insulation (16 o.c.) R-23 BIB	3	3.5	-	-	-	-	-
2	n	Wall Insulation (24 o.c.) R-23 BIB	3	4	1.5	1	1	-	-
4	e	Basement Wall R-19	-	-	5	2	-	0.5	0.5
4	h	Basement Wall R-23 BIB	-	-	5.5	3	1	1.5	1.5
4	i	Basement Wall R-30 ee SPF	-	-	6.5	4	2	2.5	2.5
10	a	Furnace or Boiler- 92 AFUE, PSC	-	1	3	4	4.5	5	6
10	b	Furnace or Boiler- 92 AFUE, EGM	-	1	3.5	4.5	5	5.5	7
10	c	Furnace or Boiler- 95 AFUE, EGM	0.5	1.5	4.5	5.5	6	7	8
10	d	Furnace or Boiler- 96 AFUE, EGM	0.5	1.5	5	5.5	6.5	7	8
10	e	Furnace or Boiler- 97 AFUE, EGM	0.5	1.5	5	6	7	7.5	9
13	a	Energy Star Gas, 40 gal, med draw, 0.65 UEF/0.64 EF	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13	c	Energy Star Gas instantaneous, 0.87 UEF/EF	2	2	2	1.5	1.5	1.5	1.5
13	e	Energy Star elec heat pump, 50 gal, 2.0 UEF/1.82 EF	4	5	6	5.5	5	5	4

- a. Only one item in each Category can be counted.
- b. CZ4 includes Climate Zone 4 except Climate Zone 4 Marine.
- c. CZ5 includes Climate Zone 5 and Climate Zone 4 Marine.
- d. R-values are minimum averages.
- e. U-factors and SHGC are maximum weighted averages (exception: SHGC permitted to be higher in climate zones 5-8).
- f. Building tightness and duct tightness are maximum.
- g. Effectiveness, AFUE, SEER, HSPF, EF are minimums.
- h. Cells containing a dash (-), indicate zero credits because that measure is the baseline requirement or was not shown to improve energy savings.
- i. For any measure where the installed efficiency value falls between two thresholds from the table, credit shall be taken for the highest threshold that the installed value meets or exceeds.
- j. Measured leakage is outside conditioned space.
- k. Radiant Barriers shall comply with with IBC Section 1509 and shall be installed over the entire roof deck over conditioned space.

**TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems ^{d, e}	<p><u>For other than electric heating without a heat pump: as proposed. Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC - Commercial Provisions.</u></p> <p><u>Capacity: sized in accordance with Section R403.7.</u></p> <p>Fuel Type/Capacity: Same as proposed design.</p> <p>Efficiencies:</p> <p>Electric: air source heat pump complying with prevailing federal minimum standards.</p> <p>Nonelectric furnaces: natural gas furnace complying with prevailing federal minimum standards</p> <p>Nonelectric boilers: natural gas boiler complying with prevailing federal minimum efficiencies</p>	<p><u>As proposed</u></p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p>
Cooling systems ^{d, f}	<p><u>As proposed. Capacity: sized in accordance with Section R403.7.</u></p> <p>Fuel Type/Capacity: Same as proposed design</p> <p>Efficiency: complying with federal minimum standards</p>	<p><u>As proposed</u></p> <p>As proposed</p> <p>As proposed</p>
Service water heating ^{d, e, f, g}	<p><u>As proposed. Use: same as proposed design.</u></p> <p>Fuel type: Same as proposed design</p> <p>Efficiency: complying with prevailing federal minimum standards</p> <p>Use: gal/day = 30 + 10 x Nbr</p> <p>Tank temperature: 120°F</p>	<p><u>As proposed</u></p> <p><u>Use, in units of gal/day = 30 + (10 N_{br})</u></p> <p><u>where:</u></p> <p><u>N_{br}=number of bedrooms</u></p> <p>As proposed</p> <p>As proposed</p> <p>Same as standard reference</p> <p>Same as standard reference</p>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

- a. Where required by the *code official*, testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals*, page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26.19 for intermittent mechanical ventilation.

- c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
- h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

$$AF = A_s \times FA \times F$$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

L and CFA are in the same units.

R407.1 (IRC N1107.1) Scope. This section establishes options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code* to demonstrate compliance with this code.

Exception: These requirements shall not apply to:

1. Homes, Townhouses and one and two family dwellings complying under the Energy Rating Index (R406)
2. Alternations, renovations and repairs to an existing building
3. Additions with a conditioned floor area of less than 1,200 square feet.

Commenter's Reason: This public comment addresses concerns with the original proposal from both the committee and other stakeholders. The main area of opposition was with equipment efficiency trade-offs in the performance path, Table 405.5.2 (1). For this reason, we have reverted the language back to the current language, thereby removing the ability to trade off equipment efficiencies in the performance path. Additionally, this public comment removes product-specific descriptions, updates to correct terminology in the charging paragraph, and updates credits appropriately within Table 407.1 - Energy Efficiency Measures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment is mainly editorial in nature. The proposal will increase the cost of construction. However, it has been determined,

using current homebuilder cost data, that this proposal provides paths with at least a 10-year (or better) simple payback. This proposal has also been determined to be cost effective using the life cycle analysis method.

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: RE208 would be a huge efficiency rollback and should be disapproved as recommended by the IECC-Residential Committee. RE208 combines an HVAC/hot water simulated performance path equipment trade-off with a proposal to add a new section requiring additional efficiency options. These two antithetical aspects of the proposal generate conflicting results, but the net impact would be a significant reduction in energy efficiency. While we would like to see additional energy efficiency requirements, we agree with the Committee that "This is not a mechanism to move forward ..." because the proposal pairs what, at best, may be considered a small step forward (additional efficiency options) with a huge step backward (equipment trade-offs) in energy efficiency. We support the Committee's recommendations to reject all of the proposals that incorporate equipment trade-offs into the performance path baseline, including RE208 (see also our public comments on RE175, RE176, and RE179). As for a vehicle for establishing additional efficiency requirements, other proposals, such as RE206 or RE209, do a much better job and do not contain the disastrous equipment trade-off rollbacks.

RE208 is one of several proposals to add new trade-offs in the simulated performance compliance path for various measures such as appliances, renewables, lighting, heating/cooling equipment, and hot water equipment (see also RE152, RE156, RE175, RE176 and RE179). These proposals are collectively some of the biggest threats to energy efficiency proposed in this code cycle. These trade-offs do not even purport to increase efficiency, but instead would all result in less efficient buildings over the long-term that cost consumers more, use more energy and provide less comfort and sustainability. They would promote replacing long-lasting building efficiency measures, such as adequate insulation, efficient fenestration and reduced air and duct leakage, with measures that have much shorter useful lives, carry substantial free ridership and lack permanence.

We fundamentally oppose simply creating more trade-offs that not only do not advance energy efficiency, but actually take a major step backward. We strongly support the Committee's consistent recommendations to disapprove all of these proposals. It is important to note that similar proposals have been consistently disapproved by ICC Governmental Member Voting Representatives in the past three code cycles.

While by far the biggest problem with this proposal is reintroduction of equipment trade-offs, this proposal also suffers from other significant issues. The proposal attempts to establish additional energy efficiency requirements under the IECC (an idea/concept we support) but is hamstrung by practical problems. The proposal looks like a variation on the Flex Points proposals offered by EECC in previous code cycles and in RE206 in this code cycle but is both problematic and far less efficient and reasonable. First, it offers less efficiency improvement (3%, according to proponents, as compared to 5% in RE206 and 10% in RE207). Second, it fails to incorporate or even consider the lifetime (durability) of the measure. Third, it contains far too many limited measures, some of which may already be included in the IECC's prescriptive path after this cycle. Fourth, the proposal fails to adopt a consistent improvement to the ERI. EECC has submitted proposals (RE206 and RE209) that are far more efficient and do not include equipment trade-offs.

Despite the effort to outline additional efficiency measures, it seems like the primary purpose of RE209 is to reinstitute heating, cooling and hot water equipment trade-offs in the simulated performance code compliance path. These trade-offs were correctly eliminated in the 2009 version of the code and have been consistently rejected in every code cycle since then. Some of the specific issues and problems with equipment trade-offs are outlined in summary fashion below (a more detailed treatment can be found in our public comment on RE175):

- **Equipment trade-offs drastically reduce energy efficiency.** ICF International, a nationally recognized energy consulting firm, conducted a detailed analysis of the negative impacts of a similar proposal to reinstate equipment tradeoffs during the 2015 code cycle (September 2013). Specifically, the study found that introducing equipment trade-offs into the performance path would have a huge negative impact on energy efficiency – a combined national average estimated impact of between 11% and 22% reduction in efficiency depending on the climate zones and trade-offs employed. For example, installing a 90 AFUE gas furnace would reduce energy efficiency under the code by 6% to 9% depending on the climate zone (note that furnaces considerably more efficient than this are commonly installed, which would create larger trade-off credit). Similarly, installing an instantaneous (tankless) water heater alone would yield 9% trade-off "credit," which means the rest of the home could be built 9% less efficient, on average, just for installing a better water heater. Massive trade-offs (efficiency reductions) of other important energy efficiency measures (insulation, windows, air and duct leakage) would be permitted if this approach were reinstated.

- **Equipment trade-offs are not "energy neutral" as claimed by proponents.** In fact, as noted in the ICF study, equipment trade-offs result in huge losses in energy efficiency – up to a reduction of 20% or more – essentially wiping out much of the progress made in advancing energy efficiency in the IECC over the last couple of decades:
 - **Federal preemption** – Equipment trade-offs are fundamentally a problem because unlike other parts of a building (such as building envelope components) that can be directly regulated by state and local governments (and the IECC), federal law prohibits states and cities from setting reasonable energy efficiency requirements for this equipment. Only the federal government has authority to set the minimum efficiency requirements for heating, cooling, and water heating equipment, and these federal standards are often outdated and lag far behind the efficiency of commonly-installed equipment.
 - **Free ridership** – Because federal minimum efficiency requirements are so far behind commonly-installed equipment, using these values as a trade-off baseline as proposed in RE208 would create an artificial trade-off "gap", permitting builders to trade away the efficiency of the building thermal envelope for more efficient equipment that they would have installed anyway. This is a "free ridership" cost reduction for the builder, but it results in much higher energy costs being imposed on the homeowner. State-level field studies have consistently shown that equipment installed in new homes is typically far more efficient than the federal minimum efficiencies (due to market forces) without any code trade-off or requirement. For example, studies in NY and PA found the market penetration of 90 AFUE or better gas furnaces (roughly 10% more efficient than the federal minimum) was above 90%. Allowing trade-off credit for above-minimum efficiency equipment in these situations would simply be a give-away to builders and a major blow to homeowners, as well as to sustainability and the environment.
- **Equipment trade-offs trade away long-term energy efficiency for short-term builder cost reduction.** Equipment trade-offs encourage builders to trade away the long-term benefits (to homeowners) of features such as an efficient thermal envelope, in favor of short-term cost cutting in the form of more efficient equipment, which will be replaced several times over the lifetime of the home. For example, if a trade-off is permitted for water heater efficiency, an instantaneous natural gas water heater would allow the builder to reduce the efficiency of the rest of the home by an average of 9%. The remaining home will be 9% less efficient for its entire useful lifetime. As the water heater is replaced every 10-15 years, the envelope of that home will continue to underperform by 9%. By contrast, under the current code, no trade-off credit is awarded for the instantaneous water heater, which means the rest of the home will be built to meet the code. As the water heater is swapped out in future years, the current code home will outperform the trade-off home by 9%.
- **It is unnecessary to address efficient equipment in the performance path; the issues are already much better addressed in the ERI compliance path.** This is because the ERI Index target is set at a level low enough to recapture most of the free-ridership losses (in addition to reasonable thermal envelope backstops). The simulated performance path does not have the built-in protections of the ERI path.
- **Equipment trade-offs have been eliminated in the vast majority of states consistent with state and federal law and policy.** Most states have adopted the IECC and completely eliminated equipment trade-offs, turning the page on this efficiency loophole with no negative impact. Introducing these trade-offs also raises several complicated issues for states in the areas of ARRA compliance and federally-insured mortgages.

Most states have been enforcing building energy codes with no equipment trade-offs for a number of years now, and with great success. There is no evidence that eliminating trade-offs has affected installation of high-efficiency furnaces, air conditioners, or water heaters. In fact, the market penetration of efficient equipment continues to grow. Reinstating these trade-offs, *after more than a decade without them*, would move energy efficiency for the rest of the home sharply backward for no good reason, and would create a host of new problems.

Bibliography: <https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/residential-baseline-study/Vol-3-HVACRes-Baseline.pdf>
<https://www.energycodes.gov/compliance/energy-code-field-studies>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1510

RE209-19

IECC@: R401.2, R401.2.1 (New), SECTION R407 (New), R407.1 (New), R407.2 (New), R407.2.1 (New), R407.2.2 (New), R407.2.3 (New), R407.2.4 (New), R407.2.5 (New)

Proposed Change as Submitted

Proponents: Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R401.2 Compliance. Projects shall comply with Section R401.2.1 and one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 Additional Energy Efficiency (Mandatory). This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one of the Additional Efficiency Package Options shall be installed according to Section R407.2.
2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following::
 - 2.1. One of the Additional Efficiency Package Options in Section R407.2 shall be installed without including such measures in the proposed design under Section R405; or
 - 2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the *standard reference design*.
 3. For buildings complying under the energy rating index alternative in Section R406, the energy rating index value shall be at least 5 percent less than the energy rating index target specified in Table R406.4.

The option selected for compliance shall be identified in the Certificate required by Section R401.3.

SECTION R407 **ADDITIONAL EFFICIENCY PACKAGE OPTIONS**

R407.1 Scope. This section establishes Additional Efficiency Package Options to achieve additional energy efficiency in accordance with Section R401.2.1.

R407.2 Additional Efficiency Package Options. Additional efficiency package options for compliance with Section R401.2.1 are set forth in Sections R407.2.1 through R407.2.5.

R407.2.1 Enhanced envelope performance option. The total building thermal envelope UA, the sum of U-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the U-factors in Table R402.1.4 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section R402.1.5. The area-weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table R402.1.2.

R407.2.2 More efficient HVAC equipment performance option. Heating and cooling equipment shall meet or exceed one of the following efficiencies:

1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.
2. Greater than or equal to 10 HSPF / 16 SEER air source heat pump.
3. greater than or equal to 3.5 COP ground source heat pump.

For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

R407.2.3 Reduced energy use in service water heating option. The hot water system shall meet or exceed one of the following efficiencies:

1. Greater than or equal to 82 EF fossil fuel service water heating system.
2. Greater than or equal to 2.0 EF electric service water heating system.
3. Greater than or equal to 0.4 Solar Fraction solar water heating system.

R407.2.4 More efficient duct thermal distribution system option. The thermal distribution system shall meet or exceed one of the following efficiencies:

1. 100 percent of ducts and air handlers located entirely within the *building thermal envelope*.
2. 100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope*.
3. 100 percent of duct thermal distribution system located in *conditioned space* as defined by Section R403.3.7.

R407.2.5 Improved air sealing and efficient ventilation system option. The measured air leakage rate shall be less than or equal to 3.0 ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).

Reason: The purpose of this code change proposal is to improve the energy efficiency of residential buildings by roughly 5% or more, and to provide code users with flexibility to select the measures that make the most sense for each project. This proposal largely mirrors the format of Section C406 Additional Efficiency Package Options—an approach to improving commercial buildings that has been included in the commercial energy code since the 2012 IECC. Like Section C406, new Section R407 offers multiple straightforward improvements that will increase energy savings and reduce costs to the homeowner over the useful life of the building. In addition, Section R401.2.1 provides two additional means of demonstrating compliance: 1) code users may achieve a 5% improvement in the performance path; or 2) code users may comply by applying a 5% improvement in ERI Target score. The range of options will provide multiple paths for projects to achieve the intended improvement in the code. The technologies included in the packages of improvements are currently available in the relevant markets and the improved building practices have been proven feasible in residential buildings. However, many of these measures would be difficult to include in the current code format because of federal preemption of covered products, inapplicability to certain home designs, or other limitations. This proposal follows the lead of states like Oregon and Washington that have successfully created a list of options available to builders to meet the residential code improvements. This approach increases flexibility for code users while advancing the code's efficiency baseline.

Although the historic energy efficiency gains in the 2009 and 2012 IECC have been largely maintained in the 2015 and 2018 IECC, there is a clear need for more substantial improvements in the 2021 IECC. It is well understood that buildings have an outsized impact on the nation's energy demands. Buildings consume 42% of the nation's energy, including 54% of the nation's natural gas and 71% of its electricity. The nation's policymakers are increasingly turning to building energy codes as a means of addressing energy and climate goals. Several states have adopted improvements beyond the 2018 IECC, and the U.S. Conference of Mayors recently called for "putting future triennial IECC updates on a 'glide path' of steady efficiency gains that will improve the efficiency performance of millions of U.S. residential, multi-family, and commercial buildings." See 2018 U.S.C.M. Resolution 86 (June 11, 2018). While a much larger improvement in overall efficiency is warranted, a roughly 5% improvement through the adoption of this proposal would be a step in the right direction.

This proposal provides policymakers with additional options for improving the code going forward. A jurisdiction could increase the number of required options (and make a corresponding increase in the performance path and ERI required improvement). And as additional technologies and building methods become available, more options may be added to the initial list of improvements. (For example, Section C406 was expanded from 5 to 8 options in the 2018 IECC.) In sum, this proposal will allow the IECC to build upon recent improvements and create a new model for improving and adding flexibility to residential building energy codes going forward.

Bibliography: *Uniting Cities to Accelerate Focus on the Economic and Climate Benefits of Boosting America's Building Energy Efficiency*, 2019 U.S.C.M. Resolution 86 (June 11, 2018), available at <https://www.usmayors.org/the-conference/resolutions/?category=c9211&meeting=86th%20Annual%20Meeting>.

Cost Impact: The code change proposal will increase the cost of construction. For each climate zone, there are cost-effective options available that will generate energy savings and be cost effective over the useful life of the building. Although the savings will vary based on the option selected and design choices made in the building, there are multiple sensible options for achieving improved efficiency in each climate zone. On a broader scale, these improvements will help curb the nation's increasing demands for energy and contribute to a more secure energy future.

RE209-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Greatest concern is for methodology - lack of understanding and flexibility and lack of solar, it negatively impacts use of ERI (Vote: 6-5).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it is the simplest, most straightforward proposal in this code change cycle for improving the efficiency of all homes built to the residential energy code by a significant amount. The user simply chooses among five packages of efficiency improvements – improved envelope, HVAC, hot water equipment, air sealing and ventilation (with HRV) or thermal distribution (duct leakage). Each of the packages reflects reasonable efficiency improvements readily available in the market. For those seeking more flexibility, the proposal also incorporates the full flexibility of the simulated performance compliance path or the ERI, along with a 5% improvement.

RE209 was narrowly disapproved by the IECC-Residential Committee by a vote of 6-5, with all four homebuilder representatives voting to disapprove it. Without the homebuilder representatives, the proposal would have been easily approved 5-2. Of all the points- or package-based proposals considered by the Committee, RE209 received the most Committee member votes, and for good reason. RE209's primary strength is its simplicity. For several years, some states (such as Oregon and Washington) have been using approaches based on tables of efficiency options to boost the efficiency of their codes. This provides flexibility for builders to identify the most reasonable, cost-effective option for a given project, but it also does not overwhelm the process with too many options. Over time, as building practices improve and the needs of jurisdictions change, the options can be modified, more options can be added, and/or the number of options required can change. RE209 is modeled on the IECC Section C406 Additional Efficiency Package Options, which has worked well for commercial buildings since it was added to the IECC in 2012.

We readily acknowledge that the costs and benefits (including energy savings) of individual option packages will vary across climate zones and even from one home to another. However, this is a positive feature of RE209, not a flaw. We expect that users will identify the option package that makes the most sense for each project. Indeed, we believe that most builders would rather have the flexibility of choosing from several options rather than requiring all homes to comply with a single set of measures that would produce a specific percentage improvement to the IECC. It is also important to note that builders will also have the flexibility and choice to comply under either the performance path or the Energy Rating Index and create their own approach to achieve a 5% savings in energy, if those compliance approaches are more familiar or better suited to a particular home.

The two concerns identified by those on the Committee who voted against this proposal are not persuasive and do not justify missing this crucial opportunity to substantially increase efficiency:

Committee: "Greatest concern is for methodology – lack of understanding and flexibility and lack of solar ..." We do not think this concern is valid. As noted above, the proposal is relatively simple and straightforward. The five efficiency package options are easy to understand and offer a considerable amount of flexibility and choice. However, additional flexibility is available if desired from both the simulated performance compliance path or the ERI, with a 5% improvement.

RE209 does not include solar or other on-site renewable electricity generation among these efficiency options because generation is not an efficiency option - it would not actually reduce the energy use of the building like the proposed efficiency options would. While we are not opposed to properly incorporating on-site renewable energy into net-zero buildings, RE209 is designed specifically to improve efficiency, so RE209 focuses on reducing the actual energy use of the building. We think energy efficiency should be optimized before considering the impact of on-site generation, which can be addressed in other proposals. We do not want to promote a choice in the code between improved energy efficiency and renewable energy.

Committee: "[I]t negatively impacts use of ERI." It is not clear what is meant by this comment, since RE209 has no impact on the ERI, other than to set an improved ERI target. RE209 (like proposals RE206 and RE207) directly addresses the Energy Rating Index (and the performance path) to ensure that all three compliance paths improve simultaneously and consistently. The three compliance paths are difficult to compare directly, in terms of energy efficiency, because so many of the assumptions and options are different. However, where a significant improvement is proposed to one compliance path (such as 5% with RE206 and RE209 and 10% with RE207), all compliance paths should be improved to the same level.

Applying a 5% improvement to the ERI and a 5% improvement to the simulated performance path for those who choose these compliance pathways is a reasonable way to improve the IECC by roughly the same amount across all compliance paths.

In sum, RE209 provides a simple, straightforward means of improving efficiency in the IECC, while preserving flexibility and simplicity, and should be approved as submitted.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As stated in the original proposal, for each climate zone, there are cost-effective options available that will generate energy savings and be cost effective over the useful life of the building. Although the savings will vary based on the option selected and design choices made in the building, there are multiple sensible options for achieving improved efficiency in each climate zone. On a broader scale, these improvements will help curb the nation's increasing demands for energy and contribute to a more secure energy future.

Public Comment# 1512

RE210-19

IECC: R407 (IRC N1107) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Add new text as follows:

SECTION R407 (IRC N1107) **PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE**

R407.1 (IRC N1107.1) Scope. This section establishes criteria for jurisdictions to attain zero energy compliance using an Energy Rating Index (ERI) analysis by the year 2042.

R407.2 (N1107.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as "Mandatory" be met.

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R-* value of not less than R-8.

R407.3 (IRC N1107.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ANSI/ICC 301 except for buildings covered by the *International Residential Code*, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-2.

Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)] (Equation 4-2)

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

R407.4 (IRC N1107.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have a score less than or equal to the values in Table R407.4, for the ERI implementation date, when compared to the *ERI reference design* for each of the following conditions:

1. ERI value without on-site renewable energy generation
2. ERI value with on-site renewable energy generation

**TABLE R407.4 (IRC N1107.4)
MAXIMUM ENERGY RATING INDEX**

ERI Implementation date	ENERGY RATING INDEX WITHOUT	ENERGY RATING INDEX WITH
	ON-SITE RENEWABLES ^a	ON-SITE RENEWABLES ^b
January 1 st 2021	60	55
January 1 st 2024	55	50
January 1 st 2027	50	45
January 1 st 2030	45	40
January 1 st 2033	40	30
January 1 st 2036	--	20
January 1 st 2039	--	10
January 1 st 2042	--	0

a. The maximum ERI without on-site renewables is fixed at an ERI of 40 after January 1st 2036, because thermal envelope and mechanical improvements cannot lower the ERI score significantly below that level.

b. The maximum ERI with on-site renewables can be achieved with or without installing onsite renewables until January 1st 2033 when on-site renewables are required to be used to lower the ERI below 40.

R407.5 (IRC N1107.5) Verification by an approved agency. Verification of compliance with the Section R407 as outlined in Section R407.4 and R407.6 shall be completed by an *approved* third party. Verification of Section R407.2 shall be completed by the authority having jurisdiction or an approved third party inspection agency per Section R105.4.

R407.6 (IRC N1107.6) Documentation. Documentation of the software used to determine the ERI and the parameters for the *residential building* shall be in accordance with Sections R407.6.1 through R407.6.3.

R407.6.1 (IRC N1107.6.1) Compliance software tools. Software tools used for determining ERI shall be approved software rating tools in accordance with RESNET/ICC 301.

R407.6.2 (IRC N1107.6.2) Compliance report. Compliance software tools shall generate a report that documents that the home and ERI score complies with Sections R407.2 through Section R407.4. The compliance documentation shall be created for the proposed design and submitted with the application for the building permit. Confirmed compliance documents of the built dwelling unit shall be created and submitted to the *code official for review* before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections R407.6.2.1 and R407.6.2.2.

R407.6.2.1 (IRC N1107.6.2.1) Proposed Compliance report for permit application. Compliance reports submitted with the application for a building permit shall include the following:

1. Building street address, or other building site identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. If Requested by the authority having jurisdiction, documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate scores indicated in Table R407.4 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation including, component level insulation R-values or U-factors, assumed duct system and building envelope air leakage testing results, as well as the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water heating equipment to be installed. The type and production size of the proposed onsite renewable Energy systems shall be reported.
6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

R407.6.2.2 (IRC N1107.6.2.2) Confirmed Compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other building site identification.
2. The name of the individual performing the analysis and generating the report.
3. The name and version of the compliance software tool.
4. If requested by the authority having jurisdiction, documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R407.2 and R407.4. The certificate shall report the energy features that were confirmed to be in the home including component level insulation R- values or U-factors.

results from any required duct system and building envelope air leakage testing, as well as, the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water heating equipment installed. The type and production size of the confirmed onsite renewable energy systems shall be reported.

R407.6.3 (IRC N1107.6.3) Additional Documentation. The code official shall be permitted to require the following Documents:

1. Documentation of the building component characteristics of the ERI reference design.
2. A certification signed by the builder providing the building component characteristics of the rated design.
3. Documentation of the actual values used in the software calculation for the rated design.

R407.6.4 (IRC N1107.6.4) Specific Approval. Performance analysis tools meeting the applicable section of Section R407 shall be approved. Documentation demonstrating the approval of the performance analysis with Section R407.6.1 shall be provided

R407.6.5 (IRC N407.6.5) Input values. Where calculation require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from RESNET/ICC 301.

Reason: As the Energy Rating Index (ERI) diverges from the Home Energy Rating System Index (HERS) it becomes important to realize that although there are commonalities between the two, they are ultimately different from each other and should be thought of separately. As soon as the R406 ERI pathway was codified it locked in the ERI to a specific version of the RESNET/ANSI/ICC 301 standard while the HERS Index is based on a continually maintained version of the same ANSI 301 standard. Therefore, we now have divergent Index scores that mean different things. The HERS Index benchmarks the efficiency of a home in comparison to a reference home that is based on the 2006 IECC. A HERS Rating is an asset rating of the energy features in a home. This means that in the process of a HERS Rating to generate the HERS Index a Rater does not necessarily inspect to see if energy features governed by the code are installed according to requirements of the code. For example, the HERS Ratings systems' insulation installation grading criteria gives guidance on how to de-rate the R-value of poorly installed insulation. The Rater is required to give a grade 3 to poor installations. The HERS Index score is intended to evaluate the performance of what is installed. It is not intended to determine if it was installed per the requirement of code. A code rating or evaluation for the generation of the ERI score, on the other hand, should only use a grade 1 because only grade 1 installation of insulation meets the requirements of manufacturer instructions and therefore code. If a Rater were to evaluate a home for an ERI score and come across grade 3 installation of insulation, the installation should fail the inspection and be re-installed to meet code requirements. In this way, an ERI rating and a HERS rating are fundamentally different. One is held to a pass/fail requirement of code and the other is a quantification and evaluation of energy assets or components of the home. This small example demonstrates how the HERS index score and the ERI score differ.

Another example that demonstrates a more pronounced difference between the indices is the codified ventilation requirements for the ERI score vs. the ventilation requirements for the HERS Index score. The ERI score uses the ASHRAE 62.2-2010 ventilation requirements while the HERS Index uses the ASHRAE62.2-2013 ventilation requirements. This difference can result in over a 10-point difference in the scores.

Many are troubled by this divergence in the index scores, but I am not because the ERI and the HERS Index are fundamentally different if related systems. The HERS Index has been adopted by builders and the public primarily as a sales and marketing tool and a means to compare the performance of houses. The HERS Index score is quite good for these purposes. The ERI, like the area weighted u-values in section R402.1.5 Total U-factor Alternative, or cost comparison in section R405 Simulated Performance Alternative is a matrix by which a home's performance can be compared to demonstrate compliance with the code. It is not intended for marketing or public consumption and as the scores continue to diverge the public will continue to be unaware of the ERI score just as they are unaware of area weighted u-values and cost compliance. If a common understanding can be created regarding this point then the ERI score can be a powerful tool to offer great flexibility for builders as well as a path forward for the code and municipalities who choose to use it to achieve greater energy efficiency.

This proposal has been designed to leverage the unique nature of the ERI and the already codified mandatory aspects of the IECC, so as to offer municipalities and builders an option that will continue the trend toward zero energy homes. As Section R407 is an optional pathway municipalities and builders can choose a code compliance path that allows great flexibility in energy specifications and design while the homebuilding industry learns how to incorporate new technologies or better use old ones. The IECC's emphasis on protecting the thermal envelope is protected not by a punitive R-value backstop, but rather by a before renewables ERI requirement. A Pre-renewables ERI score opens up flexibility through cost-effective energy tradeoffs that are the most flexible for the builder as they would include mechanical, thermal or conductive, convective losses through envelope, along with duct tightness, lights, appliances, and more. Any feature that lowers the ERI can be used. This integrated energy evaluation acknowledges that the ERI of a home cannot be lowered beyond a certain threshold unless renewables are installed, but also sets the pre-renewable ERI at a level that ensures current levels of efficiency will be created as the starting point. For example, when a builder maximizes the thermal envelope and mechanical efficiencies of their design the ERI cannot go lower than approximately 35-40. To get an ERI score below that range on-site renewables must be installed. In this way, R407, as proposed, ensures a sound building envelope and efficient mechanical systems before renewables are considered.

The uniqueness of this proposal is that it creates a timeline by which a clear incremental approach for achieving increases in efficiencies that would lead to zero energy homes can be achieved. Although this will be new to the code development world, it is tremendously important to allow the path to zero to be phased in and for giving builders and jurisdictions a timeline for planning to achieve the ultimate goal. This phased-in approach has precedence in two Colorado jurisdictions. The City of Boulder and Boulder County have both set a phased approach for attaining zero energy in their municipalities.

Section R407 is optional so only those municipalities and builders that are searching for code compliant incremental approaches need take part. It

has become a difficult argument to increase R-values, house tightness or duct leakage requirements in the 2021 IECC development cycle. This ERI approach to Zero Energy offers a logical, market-driven approach that creates a timeline for achieving significant increases in efficiency while simultaneously giving industry time to adjust and provide cost-effective solutions. This proposal also guards against building poor thermal envelopes and offsetting with on-site renewable systems. This proposal offers builders the greatest flexibility to choose how to build to meet the requirements of code.

Cost Impact: The code change proposal will increase the cost of construction

This **R407 PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE** is just that and optional alternative path way to not only demonstrate compliance with the IECC but to help jurisdictions that are interested define a measurable and incremental approach to create zero energy homes. This approach is being used in Colorado although it is true that cost of construction increases it is only required if the jurisdiction chooses to adopt the pathway.

RE210-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Supporting the intent, it provides a roadmap. Although it needs to be in an appendix, because as written it mandatory. Not convinced the ERI is the only path (Vote: 11-0).

Assembly Action:

None

RE210-19

Individual Consideration Agenda

Public Comment 1:

IECC®: APPENDIX RB (New), SECTION R407 (IRC N1107) (New), RB101 (New), RB102 (New), RB103 (New), RB103.1 (New), RB103.2 (New), RB103.3 (New), RB103.4 (New), TABLE RB103.4 (New), RB103.5 (New), RB103.6 (New), RB103.6.1 (New), RB103.6.2 (New), RB103.6.2.1 (New), RB103.6.2.2 (New), RB103.6.3 (New), RB103.6.4 (New), RB107.6.5 (New)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

APPENDIX RB **PATHWAY TO ZERO ENERGY RESIDENTIAL BUILDINGS, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE**

SECTION R407 (IRC N1107) **PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE**

RB101 R407.1 (IRC N1107.1) Scope. These provisions shall be applicable for new residential buildings where zero energy provisions are required. This section establishes criteria for jurisdictions to attain zero energy compliance using an Energy Rating Index (ERI) analysis. by the year 2042.

RB102 Compliance Existing residential buildings shall comply with Chapter 5. New residential buildings shall comply with Section RB103.

RB103 **ZERO ENERGY RESIDENTIAL BUILDINGS**

RB103.1 General. New residential buildings shall comply with Section RB103.

RB103.2 R407.2 (N1107.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as “Mandatory” be met.

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*- value of not less than R-8.

RB103.3 R407.3 (IRC N1107.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with the most recent version of the RESNET/ANSI/ICC 301 standard except for buildings covered by the *International Residential Code*, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-2. Ventilation rate, CFM = $(0.01 \times \text{total square foot area of house}) + [7.5 \times (\text{number of bedrooms} + 1)]$ (Equation 4-2). Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

RB103.4 R407.4 (IRC N1107.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have a score less than or equal to the values in Table RB103.4, for the ERI implementation plane date, when compared to the *ERI reference design* for each of the following conditions:

1. ERI value without on-site renewable energy generation
2. ERI value with on-site renewable energy generation

**TABLE RB103.4 407.4 (IRC N1107.4)
MAXIMUM ENERGY RATING INDEX**

Portions of table not shown remain unchanged.

ERI Implementation Plane date (Phased implementation dates to be determined at the time of adoption)	ENERGY RATING INDEX WITHOUT ON-SITE RENEWABLES ^a	ENERGY RATING INDEX WITH ON-SITE RENEWABLES ^b
Phase 1 (e.g. January 1 st 2021)	60	55
Phase 2 (e.g. January 1 st 2024)	55	50
Phase 3 (e.g. January 1 st 2027)	50	45
Phase 4 (e.g. January 1 st 2030)	45	40
Phase 5 (e.g. January 1 st 2033)	≤40	30
Phase 6 (e.g. January 1 st 2036)	≤40	20
Phase 7 (e.g. January 1 st 2039)	≤40	10
Phase 8 (e.g. January 1 st 2042)	≤40	0

a. The maximum lowest ERI without on-site renewables is fixed at an ERI of ≤40 at the 6th implementation phase, after January 1st 2036 because thermal envelope and mechanical improvements cannot lower the ERI score significantly below that level.

b. The maximum ERI with on-site renewables can be achieved with or without installing onsite renewables until implementation phase 5 January 1st 2033 when on-site renewables are required to be used to lower the ERI below 40.

RB103.5 R407.5 (IRC N1107.5) Verification by an approved agency. Verification of compliance with appendix RB, the Section R407 as outlined in Section RB103.4 and RB103.6 R407.4 and R407.6 shall be completed by an *approved* third party. Verification of Section RB103.5 R407.2 shall be completed by the authority having jurisdiction or an approved third party inspection agency per Section R105.4.

RB103.6 R407.6 (IRC N1107.6) Documentation. Documentation of the software used to determine the ERI and the parameters for the *residential building* shall be in accordance with Sections RB103.6.1 through RB103.6.3, R407.6.1 through R407.6.3.

RB103.6.1 R407.6.1 (IRC N1107.6.1) Compliance software tools. Software tools used for determining the ERI score shall be approved software rating tools in accordance with ANSI/RESNET/ICC 301.

RB103.6.2 R407.6.2 (IRC N1107.6.2) Compliance report. Compliance software tools shall generate a report that documents that the home and ERI score complies with Sections RB103.2 R407.2 through Section RB103.4 R407.4. The compliance documentation shall be created for the proposed design and submitted with the application for the building permit. Confirmed compliance documents of the built dwelling unit shall be created and submitted to the *code official for review* before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections RB103.6.2.1 and RB103.6.2.2, R407.6.2.1 and R407.6.2.2.

RB103.6.2.1 R407.6.2.1 (IRC N1107.6.2.1) Proposed Compliance report for permit application. Compliance reports submitted with the application for a building permit shall include the following:

1. Building street address, or other building site identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. ~~If Requested by the authority having jurisdiction,~~ Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate scores indicated in Table R407.4 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation including, component level insulation R-values or U-factors, assumed duct system and building envelope air leakage testing results, as well as the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water heating equipment to be installed. The type and production size of the proposed onsite renewable Energy systems shall be reported.
6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

RB103.6.2.2 R407.6.2.2 (IRC N1107.6.2.2) Confirmed Compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other building site identification.
2. The name of the individual performing the analysis and generating the report.
3. The name and version of the compliance software tool.
4. ~~If requested by the authority having jurisdiction,~~ Documentation of all inputs entered into the software used to produce the results for the

reference design and/or the rated home.

5. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R407.2 and R407.4. The certificate shall report the energy features that were confirmed to be in the home including component level insulation R- values or U-factors, results from any required duct system and building envelope air leakage testing, as well as, the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water heating equipment installed. The type and production size of the confirmed onsite renewable energy systems shall be reported.

RB103.6.3 ~~R407.6.3 (IRC N1107.6.3)~~ Additional Documentation. The code official shall be permitted to require the following Documents:

1. Documentation of the building component characteristics of the ERI reference design.
2. A certification signed by the builder providing the building component characteristics of the rated design.
3. Documentation of the actual values used in the software calculation for the rated design.

RB103.6.4 ~~R407.6.4 (IRC N1107.6.4)~~ Specific Approval. Performance analysis tools meeting the applicable section of Appendix RB Section R407 shall be approved. Documentation demonstrating the approval of the performance analysis with Section RB103.6.1 ~~R407.6.1~~ shall be provided

RB107.6.5 ~~R407.6.5 (IRC N407.6.5)~~ Input values. Where calculation require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from RESNET/ICC 301.

Commenter's Reason: The committee supported the intent of this zero energy proposal as it provides a road map and a phased in approach. They believed it should be in an appendix rather than a new Section R407. Therefore the proposal has been changed into an appendix. In addition the object of the proposal is to demonstrated a phased in approach to get to zero energy building so Table RB103.4 has been reworked with phases and example time lines. The ERI path to Zero may not be the only way to quantify achieving zero energy as the committee noted but is a currently a proven path that jurisdictions now can adopt if they choose to.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This **APPENDIX RB PATHWAY TO ZERO ENERGY RESIDENTIAL BUILDINGS, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE** is just that, an optional alternative path way to, not only demonstrate compliance with the IECC, but to help jurisdictions that are interested define a measurable and incremental approach to create zero energy homes. This approach is being used in Colorado although it is true that cost of construction increases it is only required if the jurisdiction chooses to adopt the pathway.

Public Comment# 2120

RE212-19

IECC: R502.1 (IRC N1108.1), R502.1.1 (IRC N1108.1.1), R502.1.1.1 (IRC N1108.1.1.1), R502.1.2 (IRC N1108.1.2), R502.1.2.1 (IRC N1108.1.2.1) (New), R502.1.3 (IRC N1108.1.3) (New), R502.1.3.1 (IRC N1108.1.3.1) (New), R502.1.4 (IRC N1108.1.4) (New), R502.1.4.1 (IRC N1108.1.4.1) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION R502 ADDITIONS

Revise as follows:

R502.1 (IRC N1108.1) General. ~~Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. code unless required to do so by the chosen compliance pathway. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition does not use more energy than the existing building. Additions shall be in accordance with Section R502.1.1 or R502.1.2, by using either the prescriptive path in Section R502.1.1, simulated performance path in Section R502.1.2, or the energy rating index path in Section R502.1.3.~~

R502.1.1 (IRC N1108.1.1) Prescriptive Additions prescriptive compliance. ~~Additions shall comply with Sections R502.1.1.1 through R502.1.1.4.~~

R502.1.1.1 (IRC N1108.1.1.1) Building envelope. ~~New building envelope assemblies that are part of the addition alone shall comply with the prescriptive Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4, R402.3, and R402.4.1.1.~~

~~**Exception:** Where unconditioned space is changed to conditioned space, the building envelope of the addition shall comply where the Total UA, as determined in Section R402.1.5, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to the Total UA generated for the existing building.~~

R502.1.1.2 (IRC N1108.1.1.2) Heating and cooling systems. ~~New heating, cooling and duct systems that are part of the addition shall comply with Section R403.~~

~~**Exception:** Where ducts from an existing heating and cooling system are extended to an addition, duct systems with less than 40 linear feet (12.19 m) in unconditioned spaces shall not be required to be tested in accordance with Section R403.3.3.~~

R502.1.1.3 (IRC N1108.1.1.3) Service hot water systems. ~~New service hot water systems that are part of the addition shall comply with Section R403.4.~~

R502.1.1.4 (IRC N1108.1.1.4) Lighting. ~~New lighting systems that are part of the addition shall comply with Section R404.1.~~

Revise as follows:

R502.1.2 (IRC N1108.1.2) Existing plus addition compliance (Simulated Performance Alternative). ~~Cost compliance verification shall demonstrate that the existing building plus the addition does not use more energy than the existing building did prior to the addition. This method requires the project to create cost compliance verification at three stages:~~

- ~~1. A baseline cost compliance of the existing structure prior to construction.~~
- ~~2. Projected cost compliance of the existing building plus the addition based on the proposed design for the building in its entirety.~~
- ~~3. Confirmed cost compliance to verify whole building performance. Where unconditioned space is changed to conditioned space, the addition shall comply where the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy cost of the existing building when modeled in accordance with Section R405. The addition and any alterations that are part of the project shall comply with Section R405 in its entirety.~~

Add new text as follows:

R502.1.2.1 (IRC N1108.1.2.1) Reporting. ~~Both the baseline and the projected cost compliance reports that include documentation of the proposed design shall be submitted with the construction documents. A confirmed cost compliance report shall be submitted prior to final inspection.~~

R502.1.3 (IRC N1108.1.3) Existing plus addition compliance (Energy Rating Index Alternative). ~~An energy rating index score shall demonstrate that the existing building plus the addition does not use more energy than the existing building did prior to the addition. This method requires the project to obtain an ERI score at three stages:~~

- ~~1. A baseline ERI of the existing structure prior to construction.~~
- ~~2. A projected ERI of the existing building plus the addition based on the proposed design for the building in its entirety.~~

3. A confirmed ERI to verify whole building performance.

R502.1.3.1 (IRC N1108.1.3.1) Reporting. Both the baseline and the projected ERI compliance reports that include documentation for the proposed design shall be submitted with the construction documents. A confirmed ERI report shall be submitted prior to final inspection.

R502.1.4 (IRC N1108.1.4) Existing plus addition compliance (Prescriptive). The existing building plus the addition shall demonstrate that the structure in its entirety does not use more energy than the existing building did prior to adding the addition. All prescriptive measures shall be installed in the addition in accordance Section R402.1. A blower door test shall be performed to establish a baseline air leakage rate for the existing building prior to construction. Prior to final building inspection, a blower door test shall be conducted on the existing building plus addition to demonstrate an air leakage rate equal to or less than the baseline measurement.

R502.1.4.1 (IRC N1108.1.4.1) Reporting. A baseline blower door testing report for the existing building prior to construction shall be submitted with the construction documents. A confirmed blower door testing report shall be submitted after construction is complete and prior to final inspection.

Reason: The current existing buildings chapter 5 of the IECC has always struggled with clearly executing the energy code provisions on additions to an existing building. A building science approach teaches us that the house is a system. Therefore, if an addition is added to an existing building then the system's configuration has changed and assessing compliance on a portion of the system becomes a problem. In reality, it is not possible to assess a portion of the system separated from its entirety for energy code compliance. However, the code has established a method, but not a clear means for trying to do so.

In one form or another the IECC has always stated that an addition shall be deemed to comply where the building with the addition does not use more energy than the existing building did without the addition. The proposal for this section leverages this language (or method) and the existing paths (the means) in the code to offer better compliance mechanisms. The proposed Section R502.1.4 Existing plus addition compliance (Prescriptive), for example, uses a baseline pre-blower door test compared to a final confirmed blower door test to demonstrate if the final product is better than or equal to the existing benchmarked building. The assumption is that the prescriptive R-values, U-values, and installation requirements for the specification installed in the addition will be better than what has been installed in the existing portions of the building. Since it is not practical and, in most cases, possible to perform a blower door on just the addition the requirement changes in order to use the blower door as a compliance mechanism.

A Simulated Performance and Energy Rating Index path have been added as alternative compliance mechanisms in this section of the code for three reasons. First, the blower door is moved back to an assessment of energy performance rather than used as a compliance mechanism. Second, it is our experience that existing portions of a building are almost always touched during the creation of an addition on a building. Therefore, these compliance paths look at the entirety of the building rather than just the addition. Third, design flexibility is achieved when one is not required to use every portion of the prescriptive specification outlined in the code. The clear ability to use tradeoffs in existing buildings fits better with the reality of construction in this arena. Forth, these two pathways enable and encourage pre-planning as well as offer a very clear matrix of compliance. The software analysis to generate the proposed design for the existing building plus the addition clearly projects if the new building in its entirety, will be better than or equal to the existing benchmarked building. The projection enables the designer to forecast what in the existing building must be addressed which helps create better building budgets and expectations. In addition, a variety of options can be presented to pick what in the existing and new sections of the building makes the most sense to address.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Demonstration of compliance with this code is required regardless, so adding additional options for demonstrating compliance would not add to the cost. It is not a certainty, but added flexibility could reduce the cost of construction as well as jurisdictional time spent on enforcement.

RE212-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The code currently does not requiring upgrading existing buildings that are not effected, this would undo that. This adds to complexity. (Vote: 9-2)

Assembly Action:

None

RE212-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R502, R502.1 (IRC N1108.1), R502.1.1 (IRC N1108.1.1), R502.1.1.1 (IRC N1108.1.1.1), R502.1.1.2 (IRC N1108.1.1.2), R502.1.1.3 (IRC N1108.1.1.3), R502.1.1.4 (IRC N1108.1.1.4), R502.2 (IRC N1108.2) (New), R502.1.2.1 (IRC N1108.1.2.1) (New), R502.3 (IRC N1108.3), R502.4 (IRC N1108.4) (New), R502.1.3.1 (IRC N1108.1.3.1) (New)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R502 ADDITIONS

R502.1 (IRC N1108.1) General. *Additions* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing *building* or *building* system to comply with this code. ~~unless required to do so by the chosen compliance pathway.~~ *Additions* shall not create an unsafe or hazardous condition or overload existing *building* systems. An *addition* shall be deemed to comply with this code where the *addition* alone complies using section R502.1.1, ~~by using either the prescriptive path in Section R502.1.1, simulated performance path in Section R502.1.2, or the energy rating index path in Section R502.1.3~~ where the existing *building* and *addition* comply with this code as a single *building*, or where the *building* with the *addition* does not use more energy than the existing *building* did using Sections R502.2, R502.3 or R502.4.

~~Additions shall be in accordance with Section R502.1.1 or R502.1.2~~

R502.1.1 (IRC N1108.1.1) Additions Prescriptive compliance. *Additions* shall comply with Sections R502.1.1.1 through R502.1.1.4.

R502.1.1.1 (IRC N1108.1.1.1) Building envelope. New *building* envelope assemblies that are part of the *addition* ~~alone~~ shall comply with the prescriptive Sections R402.1, R402.2, R402.3, and R402.4.4.1.

- **Exception:** Where *unconditioned space* is changed to *conditioned space*, the *building* envelope of the *addition* shall comply where the Total UA, as determined in Section R402.1.5, of the existing *building* and the *addition*, and any *alterations* that are part of the project, is less than or equal to the Total UA generated for the existing *building*.

R502.1.1.2 (IRC N1108.1.1.2) Heating and cooling systems. New heating, cooling and duct systems that are part of the *addition* shall comply with Section R403.

Exception: Where ducts from an existing heating and cooling system are extended to an *addition*, duct systems with less than 40 linear feet (12.19 m) in *unconditioned spaces* shall not be required to be tested in accordance with Section R403.3.3.

R502.1.1.3 (IRC N1108.1.1.3) Service hot water systems. New service hot water systems that are part of the *addition* shall comply with Section R403.4.

R502.1.1.4 (IRC N1108.1.1.4) Lighting. New lighting systems that are part of the *addition* shall comply with Section R404.1.

R502.1.4 R502.2 (IRC N1108.1.4 N1108.2) Existing plus addition compliance (Prescriptive plus blower door). The existing *building* plus the *addition* shall demonstrate that the structure in its entirety does not use more energy than the existing *building* did prior to adding the *addition*. All prescriptive measures shall be installed in the *addition* in accordance with Section R402.1. This method requires the project to demonstrate compliance verification and reporting as follows:

1. A blower door test shall be performed and reported to the code official with the construction documents at the time of permit to establish a baseline air leakage rate for the existing *building* prior to construction.
2. Prior to the final *building* inspection, a confirmed blower door test shall be conducted on the existing *building* plus *addition* to demonstrate an air leakage rate equal to or less than the baseline measurement.
3. The final confirmed blower door testing report shall be submitted to the code official for the issuance of the certificate of occupancy.

R502.1.2.1 (IRC N1108.1.2.1) Reporting. ~~Both the baseline and the projected cost compliance reports that include documentation of the proposed design shall be submitted with the construction documents. A confirmed cost compliance report shall be submitted prior to final inspection.~~

R502.1.2 R502.3 (IRC N1108.1.2 N1108.3) Existing plus addition compliance (Simulated Performance Alternative). Cost compliance verification using Section R405 software analysis shall demonstrate that the existing *building* plus the *addition* does not use more energy than the

existing *building* did prior to the addition. This method requires the project to demonstrate compliance verification and reporting as follows: ~~This method requires the project to create cost compliance verification at three stages:~~

1. A baseline cost compliance analysis report of the existing structure shall be submitted to the code official with the construction documents at the time of permit prior to construction.
2. A Projected cost compliance analysis report of the existing building plus the addition based on the proposed design specifications for the building in its entirety shall be submitted to the code official with the construction documents at the time of permit prior to construction.
3. A confirmed cost compliance analysis report to verify verifying whole building cost compliance shall be submitted to the code official to demonstrate that the completed project's cost compliance is equal to or better than the baseline cost compliance for the issuance of the certificate of occupancy. performance.

~~**R502.1.2.1 (IRC N1108.1.2.1) Reporting.** Both the baseline and the projected cost compliance reports that include documentation of the proposed design shall be submitted with the construction documents. A confirmed cost compliance report shall be submitted prior to final inspection.~~

~~**R502.1.3 R502.4 (IRC N1108.1.3 N1108.4) Existing plus addition compliance (Energy Rating Index Alternative).** An energy rating index score shall demonstrate that the existing building plus the addition does not use more energy than the existing *building* did prior to the addition. This method requires the project to to demonstrate compliance verification and reporting as follows: ~~obtain an ERI score at three stages:~~~~

1. A baseline ERI analysis and report of the existing structure shall be submitted to the code official with the construction documents at the time of permit prior to construction.
2. A projected ERI analysis and report of the existing building plus the addition based on the proposed design specifications for the building in its entirety shall be submitted to the code official with the construction documents at the time of permit prior to construction.
3. A confirmed ERI analysis and report to verify verifying whole building performance ~~performance~~ ERI compliance shall be submitted to the code official to demonstrate that the completed project's ERI score is equal to or better than the baseline ERI score for the issuance of the certificate of occupancy.

~~**R502.1.3.1 (IRC N1108.1.3.1) Reporting.** Both the baseline and the projected ERI compliance reports that include documentation for the proposed design shall be submitted with the construction documents. A confirmed ERI report shall be submitted prior to final inspection.~~

Commenter's Reason: Public Comment Reason Statement

The committee rightly pointed out that the current existing buildings code does no upgrading portions of the building that has not been touched by the addition. However, the existing code language can require the addition to demonstrate compliance in ways that are impossible because it is generally impossible to completely separate the addition from the existing building. For example, the existing language requires the addition to comply with Section R402.4 Air Leakage including blower door testing. In most cases, it is not possible to perform a blower door test on an addition alone. In addition, when it is possible the volume of the addition is usually so small that it becomes impossible to achieve 3 or 5 ACH50.

To address the committee's concerns this section has been adapted to continue to allow true prescriptive compliance based on the addition alone. The three alternative paths that have been added have been adapted and upgraded to leverage existing code language that states, "an addition shall be deemed to comply with the code....where the existing *building* and *addition* comply with this code as a single *building*, or where the *building* with the *addition* **does not use more energy than the existing building.**" The three alternative compliance pathways added to this section of the code offer existing means to quantify the energy use of the existing structure and the new existing structure plus the addition so that a code official can offer greater flexibility for the construction of additions and their interaction with the existing structure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal is intended to be cost-neutral. Demonstration of compliance with this code is required regardless, so adding additional options for demonstrating compliance would not add to the cost. That being said additional flexibility could be perceived to add cost because of extra verification, modeling, or testing. The reality is that Simulated Energy Cost Compliance is already allowed so additional options would not raise cost unless the path is chosen. It is not a certainty, but added flexibility could reduce the cost of construction as well as jurisdictional time spent on enforcement.

Public Comment# 2061

RE217-19

IECC: R503.1.1 (IRC N1109.1.1)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., IECC_LL_C representing the National Roofing Contractors Association, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

R503.1.1 (IRC N1109.1.1) Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

1.	Storm windows installed over existing fenestration.
2.	Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3.	Construction where the existing roof, wall or floor cavity is not exposed.
4.	Roof re-cover.
5.	Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing. <u>Roof replacement, where the required R-value of insulation entirely above the roof deck cannot be provided due to thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curb(s), low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum approved thickness of insulation compatible with the available space and existing uses shall be installed.</u>
6.	Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

Reason: This proposal is based on CE287-16, and resubmitted for flat-roof residential applications where the required R-value of insulation entirely above the roof deck cannot be provided due to thickness limitations. CE287-16 received a Committee recommendation of "Disapproval," a Public Comment recommendation of "As Modified by Public Comment" (AMPC), but ultimately did not receive the two-thirds necessary to prevail during the "Online Governmental Consensus Vote" (OGCV), leading to "Disapproval" as its Final Action.

Specifically, the newly proposed exception addresses the AMPC and the challenge of constructability when installing additional roof insulation in *reroofing* situations including *roof recover* and *roof replacement* where existing conditions do not allow for the full thickness of insulation required by Table R402.1.2 or Table R402.1.4. Consider the square footage of residential buildings with flat roofs (i.e., "two-flats" and "three-flats") constructed before an adoption of the 2009 IECC, that now require *reroofing*, without adequate "clear space" to accommodate up to 5+ inches (R-25-ish) or 6+ inches (R-30-ish) of insulation as the IECC evolved thru 2012 to 2015 and now the 2018 Editions. The building stock now considered 10 to 20 to 30+ years old, is far more likely to avail itself of skylight and structural curb heights, scupper and sump depths, door and window access thresholds that would turn into ponds, if five to six inches of insulation were "retroactively" foisted upon building ownership.

Moreover, if the IECC CDC were to consult the premise to Section R505.1, that "... [neither] an increase in demand for either fossil fuel [nor] electrical energy shall comply with this code," so long as the current level of insulation in the roof is replaced with an equivalent thickness/level/R-value of NEW! insulation product, you'd likely conclude that the newly proposed Exception 5 is a "do-no-harm" proposition.

Should the Committee agree with the newly proposed Exception 5, then the continuance of current Exception 5 is unnecessary, as both the current Exception 4 (*Roof re-cover*) and the New! Exception 5 (*Roof replacement*) address all circumstances defined as *Reroofing*.

We believe the proposal makes clear that the maximum thickness of insulation compatible within the technically-feasible limitations of "available space" and maintaining "positive drainage" is to be installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This change better positions the IECC to be clearer, more easily applied to *reroofing*, more competitive than the 90.1 Standard alternative on this issue; thereby no cost impact when compared with current provisions.

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

R503.1.1 (IRC N1109.1.1) Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

Storm windows installed over existing fenestration.

Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

Construction where the existing roof, wall or floor cavity is not exposed.

Roof re-cover.

Roof replacement, where the required *R*-value of insulation entirely above the roof deck cannot be provided due to thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curb(s), low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum *approved* thickness of insulation compatible with the available space and existing uses shall be installed.

Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

Roofs without insulation in the cavity and where the sheathing or insulation is exposed during *reroofing* shall be insulated either above or below the sheathing.

Committee Reason: The proposal as modified provides necessary provisions for builders and code officials to address this situation, the modification retains previous exception 5 as needed (Vote 6-5).

Assembly Action:

None

RE217-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EEC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is unnecessary and creates an overbroad exception to the roof replacement requirements of the IECC. The result will be less discretion on the part of the code official and reduced energy efficiency.

The IECC currently sets a straightforward, clear set of requirements that apply to roof replacements, and then leaves it to code officials to exercise judgment as to whether specific circumstances warrant exceptions to these requirements. RE217 creates several problems:

- It creates a long list of automatic exemptions from the insulation requirements, even where it might have been perfectly feasible to properly insulate these areas of the roof.
- It implies that even more exemptions may apply, by starting the list with "including"
- It will discourage code officials from requiring some amount of effort on the part of the roofing contractor to meet the code requirements, because contractors will view this list as an exemption from the code.

Roof replacement is one of very few opportunities to significantly improve the efficiency of existing buildings. Any exceptions should be narrowly written and well-justified. RE217 is too broad and takes too much discretion out of the hands of code officials, and it should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1497

Public Comment 2:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); marcin pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates confusion within the code.

- First, the proposal will create confusion because it references requirements for "insulation entirely above the roof deck." The residential energy code does not include any requirements for insulation entirely above the roof deck.
- Additionally, the proposed exception to Section R503.1.1 for roof replacements is unnecessary because the code already provides authority to the code official where practical difficulties make compliance with the strict letter of the code impractical.
- Notwithstanding the fact that the residential energy code does not include requirements for above deck roof insulation, the proposal is overly broad because it lists common rooftop conditions that do not create barriers to compliance for residential building envelope assemblies.
- Finally, the proponent incorrectly cites the general requirement that building alterations shall not increase energy use in the reasoning statement as justification for the proposal. This general requirement is superseded by the specific code language that states that building envelope alterations shall comply with the requirements for thermal efficiency. Therefore, adding an unnecessary exception to this specific requirement will result in a weakening of the overall code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1626

RE223-19

IECC: Appendix RB (IRC Appendix Q) (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org); Lauren Urbanek, Natural Resources Defense Council, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new text as follows:

Appendix RB (IRC Appendix Q) **ZERO ENERGY RESIDENTIAL BUILDING PROVISIONS**

RB102 (IRC AQ 102) COMPLIANCE *(Note: language to replace R401.2 Compliance)*

Existing residential buildings shall comply with Chapter 5. New residential buildings shall comply with Section RB103.

RB103 (IRC AQ 103) **ZERO ENERGY RESIDENTIAL BUILDINGS**

RB103.1 (IRC AQ103.1) General. New residential buildings shall comply with Section RB103.

RB103.2 (IRC AQ103.2) Energy Rating Index Zero Energy Score. Compliance with this section requires that the *rated design* be shown to have a score less than or equal to the values in Table RB103.2 when compared to the *ERI reference design* determined in accordance with RESNET/ICC 301 for each of the following:

1. ERI value not including net onsite power production calculated in accordance with RESNET/ICC 301, and
2. ERI value including net onsite power production calculated in accordance with RESNET/ICC 301

**TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX^a**

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 *International Energy Conservation Code*.

Reason: This proposal provides cities and states an appendix to the residential section of the 2021 IECC that would result in a residential building that has zero energy consumption over the course of a year. Jurisdictions would have the prerogative to adopt the appendix in support of policy goals related to energy efficiency and renewable energy.

The provisions contained in this appendix are not mandatory unless specified as such in the jurisdiction’s adopting ordinance.

Why is this needed?

States and cities across the country are pursuing policies to reduce the energy consumption of buildings. More than 270 cities and counties and 10 states are signatories to the “We Are Still In” commitment supporting climate action to meet the goals of the Paris climate accord. Thus far, seventy cities have committed to being powered by 100% renewable energy and more are joining all the time. The building energy code is an important policy tool for jurisdictions as they pursue these types of policy goals.

Many of these energy and climate-related goals have a target year of 2030, so the time is ripe to provide this option in the model energy code. While jurisdictions already can modify the model code to meet their needs, many do not have the in-house expertise to develop and vet this type of code language. Integrating a zero energy building pathway into the 2021 IECC as a jurisdictional option will make the model energy code a more robust policy tool. Use of appendices in the IECC have proven successful with the solar provisions in the 2018 IECC appendices.

Including a zero energy building appendix in the model energy code can smooth the transition to zero energy for builders. Rather than jurisdictions going alone— leading to a patchwork of zero energy residential code approaches—a single IECC appendix would provide consistent national language across the residential industry for manufacturers, builders and trades. Builders can standardize their construction practices across jurisdictions and states to meet these requirements. This makes education, incentive programs, and implementation significantly more straightforward and cost-effective.

How the Zero Energy appendix works

While there are a number of definitions of “zero energy buildings” (also referred to as “zero net energy,” “net zero energy,” or simply, “net zero”), the Appendix is based on the Energy Rating Index (ERI) compliance path found in section R406 of the 2018 IECC. In principle, the proposal works as follows:

1. Required ERI values are based on a highly efficient energy use performance level before considering on-site power generation.
2. The remaining energy use, on an annual level, is satisfied with on-site power generation.

The Energy Rating Index scores are set for a highly efficient level of energy consumption, which importantly, is still cost effective for the homeowner. These scores, which range from 42 to 48 based on climate zone, were calculated based on a thorough analysis of HERS scores nationwide, a survey of HERS scores for model high-performance home, modeling done for ASHRAE 90.2, and the U.S. DOE Zero Energy Ready Home program.

On-site renewable energy capacity is then required to meet the remaining energy use, resulting in an Energy Rating Index score of zero. Software required in the RESNET 301 standard can easily generate an ERI score of the home before and after the inclusion of renewable energy (known as Onsite Power Production in HERS). All renewable energy is required to be on-site. The minimum envelope backstops required in section R406 are also required in this appendix. Homes may use any fuel in accordance with RESNET 301 to comply with the Appendix.

Bibliography: Presentation: 90.2 Compliance Requirements. Results from EnergyGauge 5.0 Simulations and Economic Analysis SSPC 90.2

Orlando Meetings January 25-26, 2016. P. Fairey. Florida Solar Energy Center.
ASHRAE Standard 90.2018. Energy Efficient Design of Low-Rise Residential Buildings

Cost Impact: The code change proposal will increase the cost of construction

If adopted by the state or jurisdiction, complying with this appendix will increase the first cost of construction but the Energy Rating Index values, before the addition of onsite power production, that have been selected were found to be cost effective based on information presented to the ASHRAE Standard 90.2 committee. All of the ERI scores without onsite power production have been found to have Savings/Investment Ratios (SIR) of greater than 1.0.

RE223-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It needs additional compliance language for buildings without solar. Does not offer guidance or flexibility, it needs the term "net" included in title, and the EIR numbers are too low (Vote: 6-5).

Assembly Action:

None

RE223-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE RB103.2 (IRC AQ103.2) (New)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX^a**

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2; ~~and the proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA calculated using the prescriptive U-factors from Table R402.1.4 in accordance with Equation RB-1; and the area-weighted maximum glazed fenestration SHGC permitted shall be the SHGC values set forth in Table R402.1.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 International Energy Conservation Code.~~

$$UA_{\text{Proposed design}} \leq UA_{\text{Prescriptive reference design}} \quad \text{Equation RB-1}$$

Commenter's Reason: RE223 should be approved as submitted or as modified because it establishes a reasonable optional appendix that can be adopted by interested jurisdictions that wish to promote more efficient homes with on-site renewables to achieve net zero energy homes. (It should be noted that this proposal only failed at the Committee hearing by one vote – 6-5 – and four of the six votes against were by the builder representatives on the Committee). By making this an appendix in this cycle, it will also create a common starting place for potential further improvements in the next code cycle.

We offer the proposed modification to incorporate a Total UA-based approach into the thermal envelope backstop, using an approach similar to the compromise that was recommended by the Committee to be approved in RE150. This modification would maintain the stringency of the thermal envelope backstop but would provide some additional flexibility for builders. The modification would also reference the U-factor and R-value tables of the current code, replacing an external reference to the 2015 IECC. This will help keep the backstop up-to-date without requiring new proposals every code development cycle.

Although several proposals address on-site renewable energy in the current code development cycle, RE223 is the only residential proposal on this subject that is workable in our view. We urge approval of RE223, with or without the modification above, for the following reasons:

- It maintains and builds upon the efficiency incorporated into the IECC, rather than maintaining, or even worse, reducing energy efficiency to “make room” for on-site renewable energy. A fundamental principle should be to eliminate wasted energy in the building before turning to renewable generation for the home’s energy needs.
- It sets a strong thermal envelope trade-off backstop that will help ensure that the efficiency of the building’s permanent thermal envelope will not be traded away for less-durable components or on-site generation.
- It places the new requirements in an appendix, where progressive jurisdictions can easily incorporate them into state or local codes. Jurisdictions that are not yet ready for these requirements, or for which the requirements are logistically unworkable, need not adopt the appendix.
- The appendix is essentially an overlay of the Energy Rating Index path and will be a familiar approach to building net-zero buildings for many builders.
- The appendix offers a “net zero” and renewable option that is sought by a number of jurisdictions.

Incorporating on-site renewable energy into the IECC poses a number of challenges and risks for jurisdictions, but RE223 is the only proposal that appears to reasonably account for these risks. RE223 is a reasonable improvement to the IECC and should be approved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The modification in this public comment, if approved, could in some cases moderate the impact of these costs by adding more flexibility to the proposed thermal envelope backstop. Overall, for jurisdictions that adopt this new appendix (with or without this modification), the additional requirements for improved efficiency and renewable energy will add first costs. However, we agree with the proponent that the efficiency improvements are cost-justified.

Public Comment 2:

IECC@: RB103.2 (IRC AQ103.2) (New), TABLE RB103.2 (IRC AQ103.2) (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org); jim edelson, representing New Buildings Institute (jim@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:**2018 International Energy Conservation Code**

RB103.2 (IRC AQ103.2) Energy Rating Index Zero Energy Score. Compliance with this section requires that the *rated design* be shown to have a score less than or equal to the values in Table RB103.2 when compared to the *ERI reference design* determined in accordance with RESNET/ICC 301 for each of the following:

1. ERI value not including ~~net~~ onsite power production (OPP) calculated in accordance with RESNET/ICC 301, and
2. ERI value including ~~net~~ onsite power production calculated in accordance with RESNET/ICC 301 with the OPP in Equation 4.1.2 of RESNET/ICC 301 adjusted as follows

(Equation RB-1)

Adjusted OPP = OPP + CREF + REPC

Where:

CREF (Community Renewable Energy Facility power production): The yearly energy, in kilowatt hour equivalent (kWh_{eq}), contracted from a community renewable energy facility that is qualified under applicable state and local utility statutes and rules, and that allocates bill credits to the rated home.

REPC (Renewable Energy Purchase Contract power production): The yearly energy, in kilowatt hour equivalent (kWh_{eq}), contracted from an energy facility that generates energy with photovoltaic, solar thermal, *geothermal energy*, or wind systems, and that is demonstrated by an energy purchase contract or lease with a duration of not less than 15 years.

**TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX^a**

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power <u>OPP</u>	ENERGY RATING INDEX including Adjusted onsite power <u>OPP</u> (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 *International Energy Conservation Code*.

Committer's Reason: RE223 should be approved as modified by this Public Comment. The original proposal was recommended for disapproval by the committee by a narrow vote of 6-5. The reasons cited by the committee have been addressed through this modification. The modification address the Committee concerns as follows:

- The Committee requested that this proposal include an additional method of compliance for buildings without solar, and additional flexibility for buildings that have a limited ability to generate sufficient renewable energy on-site. These concerns are addressed through the addition of the Adjusted Onsite Power Production calculation, which allows compliance via a combination of onsite power production, energy generated through community renewable energy facilities, and renewable energy purchase contracts or leases.
 - The information needed about how much energy is being procured from each source (onsite, community facility, or through a contract/lease) will be disclosed in the contracting documents. From there, the Adjusted OPP is calculated through simple addition and entered into Equation 4.1.2 of RESNET/ICC 301. Calculation proceeds as usual within Section 4.1.2 using the Adjusted OPP to determine the Energy Rating Index.
- A home must meet two ERI score requirements, one without considering power production (ie, considering only energy efficiency) and one taking power production into consideration. The Adjusted OPP calculation for procurement of offsite kWh_{eq} is only used when calculating whether a home fulfills the requirement to have zero net energy consumption.
- This modification provides substantial flexibility for builders to comply in the way that is most cost-effective and best suits the local market.
- There was discussion during the Committee hearings that this proposal needs the term “net” included in the title. We do not feel this is necessary, as we are following the Department of Energy protocol by using the “Zero Energy Buildings” terminology.
- There was discussion during the Committee hearings that the ERI numbers are too low. In fact, the ERI values not including OPP are buildable and were found to be cost-effective based on a thorough analysis of HERS scores nationwide, a survey of HERS scores for model high-performance homes, modeling performed for ASHRAE 90.2, and the U.S. DOE Zero Energy Ready Home. The required scores are designed to be aggressive yet achievable, adopted by cities and jurisdictions ready to lead the market by adopting this optional appendix.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Complying with this appendix will increase the first cost of construction. Meeting the Energy Rating Index values before onsite power production will typically require increasing the efficiency of the building envelope (e.g. higher insulation levels, more efficient windows and reduced air envelope air leakage), increasing the heating, cooling and water heating equipment efficiencies, and also installing more efficient appliances. The additional fist cost will be dependent on the package of features that the builder chooses to meet the ERI score. While there will be an additional first cost to meet the ERI score prior to addition of onsite power production, the ERI scores selected were found to be cost effective based on information presented to the ASHRAE Standard 90.2 committee. All of the ERI scores without onsite power production have been found to have Savings/Investment Ratios (SIR) of greater than 1.0.”

Public Comment# 1904

Public Comment 3:

IECC@: TABLE RB103.2 (IRC AQ103.2) (New)

Proponents:

Martha VanGeem, self, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX^a**

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2, ~~and building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.~~

Commenter's Reason: This public comment neither supports or is asking for disapproval of RE223. Rather, it is modifying it in the event that it is approved.

The mandatory requirements of Section R406.2 already include minimum stringency requirements for U-factors and SHGC (backstops). Therefore they are not needed here and are struck in this public comment. Furthermore, the backstops in RE150 as approved as modified by the committee for Section R406.2 are preferable to those in this proposal.

Lastly, it would be best if these mandatory requirements and backstops were consistent and changed in one place rather than in multiple places.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment does not increase the cost of the construction because the comment is only redirecting the reader to the backstop that is (and for 2021, will be) in Section R406.2. What that backstop will be for the 2021 IECC is covered by other proposals. Because this public comment has no cost impact but the original proposal does have a cost increase, the net effect of both will still be an increase in the cost of construction.

RE224-19 Part I

IECC: APPENDIX RB (New)

Proposed Change as Submitted

Proponents: Theresa Weston, representing DuPont Performance Building Solutions (theresa.a.weston@dupont.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY IECC-RE COMMITTEE. PLEASE SEE THE TENTATIVE HEARING ORDERS FOR THIS COMMITTEE.

2018 International Energy Conservation Code

Add new text as follows:

Appendix RB STRETCH ENERGY CODE PROVISIONS

SECTION RB101 GENERAL

RB101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

SECTION RB102 REQUIREMENTS

RB102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2.

SECTION RB103 REFERENCE STANDARDS

Add new standard(s) as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

Reason: Some jurisdictions are interested in adopting stretch energy codes. Providing a stretch code through the reference of ANSI/ASHRAE/IES Standard 90.2-2018 allows for a stretch code that is based on an ERI methodology that is compatible with the ERI pathway within the base IECC. The ERI levels specified within 90.2-2018 have been specified as Tier 3 within the CEE New Residential Construction Specification, while the IECC 2018 ERI path is specified as Tier 1. (<https://library.cee1.org/content/cee-residential-new-construction-specification/>)

Cost Impact: The code change proposal will increase the cost of construction

The cost of construction will increase in the jurisdictions which adopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in **FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction**, dated May 20, 2015 (available at <http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf>).

Staff Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.2-2018, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RE224-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: If it is in an appendix it takes a specific action by a jurisdiction. If it is an alternative path it belongs there. Unclear if mandatory requirements are included. There is an unconfirmed potential conflict with the 2018 IECC and the potential unconfirmed comments on the 90.2.

(Vote: 7-4).

Assembly Action:

None

RE224-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION RB102 (New), RB102.1 (New)

Proponents:

Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION RB102 REQUIREMENTS

RB102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2 and the requirements identified as "mandatory" in Chapter 4.

Commenter's Reason: The inclusion of Standard 90.2 as reference for a stretch code appendix is desirable because this will encourage municipalities to adopt a uniform beyond code option to achieve greater levels of energy efficiency. As 90.2 was developed to be a leadership standard it is an excellent fit as a stretch code.

The modification is provided addresses the committee's concerns that mandatory requirements within the base code are still carried forward into the stretch code.

In reference to the committee's concerns with potential unresolved commenters during the publication process, the process allows members and interested parties to maintain their technical differences during the publication approval process. It is commonplace to have differing technical opinions during this process and is essential to the development of consensus based standards.

Bibliography: ASHRAE Standard 90.2-2018

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The first cost of construction will likely increase in the jurisdictions which adopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction, dated May 20, 2015 (available at <http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf>).

Public Comment# 1348

Public Comment 2:

IECC@: Appendix RB (New), SECTION RB101 (New), RB101.1 (New), SECTION RB102 (New), RB102.1 (New), SECTION RB103 (New), ASHRAE (New)

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**Appendix RB
STRETCH ENERGY CODE PROVISIONS**

**SECTION RB101
GENERAL**

RB101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

**SECTION RB102
REQUIREMENTS**

RB102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2 and the requirements identified as “mandatory” in Chapter 4.

**SECTION RB103
REFERENCE STANDARDS**

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

Commenter's Reason: The inclusion of Standard 90.2 as reference for a stretch code appendix is desirable because this will encourage municipalities to adopt a uniform beyond code option to achieve greater levels of energy efficiency. As 90.2 was developed to be a leadership standard it is an excellent fit as a stretch code.

The modification is provided addresses the committee's concerns that mandatory requirements within the base code are still carried forward into the stretch code.

In reference to the committee's concerns with potential unresolved commenters during the publication process, the process allows members and interested parties to maintain their technical differences during the publication approval process. It is commonplace to have differing technical opinions during this process and is essential to the development of consensus based standards.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The first cost of construction will likely increase in the jurisdictions which adopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction, dated May 20, 2015 (available at <http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf>).

Public Comment# 1174

RE224-19 Part II

IRC: APPENDIX U (New)

Proposed Change as Submitted

Proponents: Theresa Weston, representing DuPont Performance Building Solutions (theresa.a.weston@dupont.com)

2018 International Residential Code

Add new text as follows:

Appendix U STRETCH ENERGY CODE PROVISIONS

SECTION AU101 GENERAL

AU101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

Revise as follows:

SECTION AU102 REQUIREMENTS

AU102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2.

SECTION AU103 REFERENCE STANDARDS

Add new standard(s) as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

RE224-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Keeping in alignment with the decision for Part 1. If it is in an appendix it takes a specific action by a jurisdiction. If its an alternative path it belongs there. Unclear if mandatory requirements included. There is an unconfirmed potential conflict with the 2018 IECC and the potential unconfirmed comments on the 90.2. (Vote: 7-4).

Assembly Action:

None

RE224-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC@: Appendix U (New), SECTION AU101 (New), AU101.1 (New), SECTION AU102 (New), AU102.1 (New), SECTION AU103 (New), ASHRAE (New)

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

**Appendix U
STRETCH ENERGY CODE PROVISIONS**

**SECTION AU101
GENERAL**

AU101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

**SECTION AU102
REQUIREMENTS**

AU102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2 and the requirements identified as “mandatory” in Chapter N11.

**SECTION AU103
REFERENCE STANDARDS**

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

Commenter's Reason: The inclusion of Standard 90.2 as reference for a stretch code appendix is desirable because this will encourage municipalities to adopt a uniform beyond code option to achieve greater levels of energy efficiency. As 90.2 was developed to be a leadership standard it is an excellent fit as a stretch code.

The modification is provided addresses the committee's concerns that mandatory requirements within the base code are still carried forward into the stretch code.

In reference to the committee's concerns with potential unresolved commenters during the publication process, the process allows members and interested parties to maintain their technical differences during the publication approval process. It is commonplace to have differing technical opinions during this process and is essential to the development of consensus based standards.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The first cost of construction will likely increase in the jurisdictions which adopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction, dated May 20, 2015 (available at <http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf>).

Public Comment# 1175

CE1-19 Part I

IECC: Part I: SECTION C101.2, C101.3, C101.4.1, C101.5, C202, C202, (New), C401.1, C401.2, C401.2.1(New),

IECC: Part II R101.2, R101.3(N1101.2) , R101.4.1, R101.5, R202 (N1101.6), R202 (N1101.6) (New), R401, R401.2.1(N1101.13.1)(New), R401.2.2(N1101.13.2)(New), R401.3(N1101.14)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

SECTION C101 SCOPE AND GENERAL REQUIREMENTS

C101.1 Title. This code shall be known as the Energy Conservation Code of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

Revise as follows:

C101.2 Scope. This code applies to *commercial buildings* and ~~the buildings' sites and associated systems and equipment.~~ *structures*, their associated *sites*, systems and equipment; and energy-using systems and equipment associated with *sites* considered areas of land under the control of a single owner or entity.

C101.3 Intent. This code shall regulate the design and construction of *buildings*, *structures* and *sites* for the effective use and conservation of energy over ~~the their useful life of each building.~~ This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

C101.4.1 Mixed residential and commercial buildings, structures and sites. Where a *building*, *structure* or *site* includes both ~~*residential building uses* and *commercial building portions uses*~~, each portion use group shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.

C101.5 Compliance. *Residential buildings*, *structures* and *sites* shall meet the provisions of IECC—Residential Provisions. *Commercial buildings*, *structures* and *sites* shall meet the provisions of IECC—Commercial Provisions.

SECTION C202 GENERAL DEFINITIONS

Revise as follows:

~~**BUILDING SITE.** A contiguous area of land that is under the ownership or control of one owner or entity.~~

Add new definition as follows:

[A] STRUCTURE. That which is built or constructed.

SECTION C401 GENERAL

Revise as follows:

C401.1 Scope. The provisions in this chapter are applicable to commercial *buildings*, *structures* and *sites* and ~~their *building sites*.~~

C401.2 Application. *Commercial buildings*, *structures*, and *sites* shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, *commercial buildings*, *associated structures* and *sites* shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The aggregate building, structure and site energy cost shall be equal to or less than 85 percent of the standard reference design building.

Add new text as follows:

C401.2.1 Application to structures and sites. Energy-using systems and equipment serving sites or structures, with or without a contiguous building, including site lighting; motors for pumps, fountain pumps and water moving equipment; and vertical transportation equipment, elevators and escalators, shall meet the applicable provisions of this code as described in Sections C403, C404, C405, C407 and C408

Reason:

There are areas outside of the commercial and residential buildings where energy savings is possible by applying provisions currently in the IECC. Examples include lighting in parking lots that may or may not be directly associated with a commercial or residential building or lighting and equipment associated with industrial or physical plants, public or private parks and public or private campus environments. Imagine the additional and credible energy savings that could be acquired by expanding the scope and applicaiton of the IECC, as such.

This proposal expands the scope and application of the commercial provisions of the IECC to apply to energy-using systems in areas outside of the building itself. The proposal revises an existing term "BUILDING SITE" and introduces term, "STRUCTURE" utilized throughout the ICC Family of International Codes, to define those types of environments where the building may not enclose the extent of energy-using lighting, motor, pumping and vertical transportation systems and equipment addressed in the code as currently constituted. Also, a new provision is included in both Chapter 4 [CE] and Chapter 4 [RE] "Application" to address structures and sites with or without buildings.

Cost Impact: The code change proposal will increase the cost of construction

While there will be a cost impact associated with this change when compared to current provisions, the change better positions the IECC to be clearer, more easily applied to structures and sites constructed without associated buildings, and more competitive than the 90.1 Standard alternative on the issue

CE1-19 Part I

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: Clarifies that the code covers more than just buildings. Other equipment on the site is addressed by the code. The committee noted that the resulting text of Section C101.2 may need some revision to the last line for grammar and clarity (Vote: 11-4)

Assembly Action:

None

CE1-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net); William Prindle, representing EECC (wprindle@icfi.com); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it expands the scope of the IECC into uncertain territory without consideration of the potential for unintended consequences. It is hard to imagine how a building code official would assert jurisdiction over "energy-

using systems and equipment associated with sites considered areas of land under the control of a single owner or entity.” Specifically, we are concerned about the potential of extending the code beyond the specific building to some sort of collective compliance for a group of buildings, structures and sites under the control of a single entity. In our view, each building should individually comply with the code. The IECC-Residential Committee correctly disapproved Part 2 recognizing that “the proposed language could expand IECC enforcement duties/responsibilities into areas not appropriate for the IECC.” We recommend disapproval of both parts 1 and 2.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1427

CE1-19 Part II

IECC: R101.2, R101.3 (IRC N1101.2), R101.4.1, R101.5, R202 (IRC N1101.6), R401.1, R401.2 (IRC N1101.13), R401.2.1 (IRC 1101.13.1) (New), R401.2.1 (IRC N1101.13.1, R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

SECTION R101 (IRC N1101) SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. This code shall be known as the Energy Conservation Code of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

Revise as follows:

R101.2 Scope. This code applies to *residential buildings* and ~~the building sites and associated systems and equipment, structures, their associated sites, systems and equipment; and energy-using systems and equipment associated with sites considered areas of land under the control of a single owner or entity.~~ structures, their associated sites, systems and equipment; and energy-using systems and equipment associated with sites considered areas of land under the control of a single owner or entity.

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings, structures and sites* for the effective use and conservation of energy over the their useful life of ~~each building~~. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

R101.4.1 Mixed residential and commercial buildings, structures and sites. Where a *building, structure or site* includes both *residential building uses* and *commercial building portions uses*, each portion use group shall be separately considered and meet the applicable provisions of the IECC—Commercial Provisions or IECC—Residential Provisions.

R101.5 Compliance. *Residential buildings, structures and sites* shall meet the provisions of IECC—Residential Provisions. *Commercial buildings, structures and sites* shall meet the provisions of IECC—Commercial Provisions.

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

~~**BUILDING SITE.** A contiguous contiguous area of land that is under the ownership or control of one owner or entity.~~

Add new text as follows:

STRUCTURE. That which is built or constructed.

Revise as follows:

SECTION R401 GENERAL

R401.1 Scope. This chapter applies to *residential buildings, structures and sites*.

R401.2 (IRC N1101.13) Compliance. ~~Projects~~ *Buildings, structures and sites* shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 (IRC N1101.13.1) Application to structures and sites. Energy-using systems and equipment serving sites or structures, with or without a contiguous residential building, including site lighting; motors for pumps, fountain pumps and water moving equipment; and vertical transportation equipment, lifts, elevators and escalators, shall meet the applicable provisions of this code as described in Sections R403, R404, R405 and R406.

Revise as follows:

R401.2.1 R401.2.2 (IRC N1101.13.1 N1101.13.2) Tropical zone. Residential buildings, structures and sites in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter provided that the following conditions are met:

1. Not more than one-half of the *occupied* space is air conditioned.
2. The *occupied* space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in *conditioned* spaces has a *solar heat gain coefficient* of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building, at the structure, or in a conspicuous location on site*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R-values* of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U-factors* of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.

Reason:

There are areas outside of the commercial and residential buildings where energy savings is possible by applying provisions currently in the IECC. Examples include lighting in parking lots that may or may not be directly associated with a commercial or residential building or lighting and equipment associated with industrial or physical plants, public or private parks and public or private campus environments. Imagine the additional and credible energy savings that could be acquired by expanding the scope and applicaiton of the IECC, as such.

This proposal expands the scope and application of the commercial provisions of the IECC to apply to energy-using systems in areas outside of the building itself. The proposal revises an existing term "BUILDING SITE" and introduces term, "STRUCTURE" utilized throughout the ICC Family of International Codes, to define those types of environments where the building may not enclose the extent of energy-using lighting, motor, pumping and vertical transportation systems and equipment addressed in the code as currently constituted. Also, a new provision is included in both Chapter 4 [CE] and Chapter 4 [RE] "Application" to address structures and sites with or without buildings.

Cost Impact: The code change proposal will increase the cost of construction

While there will be a cost impact associated with this change when compared to current provisions, the change better positions the IECC to be clearer, more easily applied to structures and sites constructed without associated buildings, and more competitive than the 90.1 Standard alternative on the issue

CE1-19 Part II

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The proposal expands coverage of the IECC in unnecessary ways. The current code text is sufficient to address the areas of the proponent's concerns. The committee raised the concern that the proposed language could expand IECC enforcement duties/responsibilities

into areas not appropriate for the IECC. (Vote: 10-1)

Assembly Action:

None

CE1-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Darren Meyers, representing Self (dmeyers@ieccode.com)

requests As Submitted

Commenter's Reason: The IECC Residential Committee appeared anxious or unwilling to grasp what the IECC Commercial Committee clearly did - that there exist areas outside of residential buildings where energy savings is possible.

Examples include lighting in parking lots that may or may not be directly associated with a (group of) residential building(s) or a planned unit development with connected lighting power (3-story or less R-2; non-active parks or communal parking) or other electrical loads (pumps serving decorative waterfalls or a purposeful fountain(s) dedicated to aerating a community pond).

For our future, the IECC will be called upon (by both policy makers and our successors in code enforcement) to expand its application to additional and credible energy savings on residential sites that can be attained by expanding scope. This is our intent. It is neither unnecessary nor intent on expanding duties beyond the site for which code enforcement is already familiar.

More clearly stated, "the specific overrides the general." Where "specific" provisions applicable to site energy-using systems do not yet appear in the IECC, no such "general" regulation of these systems is intended until the respective IECC code development committees act on such "specific," future proposals.

We ask U.S. Code Enforcement to support this proposal (as did the IECC Commercial Committee) to expand the potential application of the residential provisions of the IECC and match action on CE1-19, Part I, to apply to energy-using systems in areas outside of the building itself.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

While there will be a cost impact associated with this change when compared to current provisions, the change better positions the IECC to be clearer, more easily applied to structures and sites constructed without appurtenant buildings, and more competitive than Standard 90.1 on the issue.

Public Comment# 1708

CE2-19

IECC: Section C101.3

Proposed Change as Submitted

Proponents: Sharon Bonesteel, Salt River Project, representing Salt River Project (sharon.bonesteel@srpnet.com); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. The shift of a load from on-peak period to off-peak shall be considered a part of the effective use of energy. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: The conservation of energy and its related cost are the foundation of the IECC. Since the cost of energy is time dependent, it makes sense to include the shift of a load from *on-peak* (most expensive per kw) to *off peak* (least expensive) as a part of the effective use of energy. The definitions for *load*, *on-peak* and *off peak* are included in another code change proposal. Those proposed definitions are as follows:

- **LOAD** A portion of a system that consumes electric energy. The total electrical *load* of a building is the sum of all electricity consuming appliances, lights and systems, necessary for a building to function as designed.
- **ON-PEAK** The time of use during which the cost per kiloWatt-hour (kWh) is the highest and when the maximum generation resources are required to supply electricity to the customer.
- **OFF-PEAK** The time of use during which the cost per kiloWatt-hour (kWh) is the lowest and when generation resources are being underutilized.

The terms are found defined in on-line sources. These could be added to the proposal, if needed, at public comment stage.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This code change clarifies that load shifting is a part of the efficient use of energy and does not increase or decrease the cost of construction.

CE2-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The Intent statement adequately covers energy conservation in the broadest sense and does not need to include a list of specific methodologies. The existing language doesn't exclude the technology discussed by the proponent. The word 'shall' is problematic in the proposed sentence in that it appears to creating a new technical requirement. (Vote: 14-1)

Assembly Action:

None

CE2-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C101.3, SECTION C202

Proponents:

Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org); Sharon Bonesteel AIA CBO CP, salt river project, representing Salt River Project (sharon.bonesteel@srpnet.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building-, ~~including the shift of a load from an on-peak period to an off-peak period, shall be considered a part of the effective use of energy.~~ This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

SECTION C202 GENERAL DEFINITIONS

LOAD. A portion of a system that consumes electric energy. The total electrical load of a building is the sum of all electricity consuming appliances, equipment, and systems necessary for a building to function as designed.

ON-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the highest and when the maximum generation resources are required to supply electricity to the customer.

OFF-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the lowest and when generation resources are being underutilized.

Commenter's Reason: This proposed modification addresses the concerns of the committee by removing the word "shall" and by adding definitions to clarify what is meant by the new language. As more renewable energy is added to the grid and to buildings, the use of load shifting will be more important.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The change to the intent and the addition of new definitions do not change the cost of construction, as they do not add any new requirements to the code.

Public Comment# 1287

CE3-19 Part I

IECC: Part I: C101.3

IECC: Part II: R101.3(N1101.2)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings and systems for the effective use and conservation of energy over the useful life of each building, including effective integration of energy efficiency measures, renewable energy systems, and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques, including innovative approaches and techniques to achieve this objective- that achieve the most cost-effective means of compliance. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Renewable energy systems are an important component of the IECC, but the Intent section is presently silent on them. Effective integration of energy efficiency measures and renewable energy systems is critical to the future of energy codes and green/stretch/reach codes. At the time of submittal of these code change proposals, there are four states with 100% renewable energy goals: Hawaii, California, New Jersey, and New York. Other communities are committing to renewable energy goals through their own local renewable goals for power supply or for installation of renewable energy systems.

As grid penetration of renewable energy systems increases, the need to energy storage systems -- mostly battery storage -- also increases. The Intent section of the IECC should evolve with our societal needs, as by the time this edition is in effect there will be even more renewable energy systems and battery storage systems.

Renewable energy is already explicitly included in the IECC in multiple locations, including, but not limited to: Section C202 Definitions; Section C407.3 Performance-based compliance; Appendix CA Solar Ready Zone; Section R406 Energy Rating Index; Appendix RA Solar Ready Provisions. The Intent section needs to catch up with the provisions within the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

CE3-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The technologies are already allowed by the existing broad text of the Intent statement. Including 'most cost effective' in the intent statement sets a dangerous threshold for judgement of future changes. Cost effective is not defined. As the Intent comes into play in the review of alternate methods and for above code programs, a determination of most cost effective would impose a difficult burden on code officials. (Vote 13-2)

Assembly Action:

None

CE3-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: C101.3

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings and systems for the effective use and conservation of energy over the useful life of each building, including effective integration of energy efficiency measures, renewable energy systems, and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques, ~~including innovative approaches and techniques that achieve the most cost-effective means of compliance to achieve this objective.~~ This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: This proposal and this public comment seeks to include "effective integration of energy efficiency measures, renewable energy systems, and energy storage systems."

This public comment reverts the second sentence back to the same text as found in the 2018 IECC intent section.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

Public Comment# 2172

CE3-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of buildings and systems for the effective use and conservation of energy over the useful life of each building, including effective integration of energy efficiency measures, renewable energy systems, and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques, including innovative approaches and techniques ~~to achieve this objective.~~ that achieve the most cost-effective means of compliance. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Renewable energy systems are an important component of the IECC, but the Intent section is presently silent on them. Effective integration of energy efficiency measures and renewable energy systems is critical to the future of energy codes and green/stretch/reach codes. At the time of submittal of these code change proposals, there are four states with 100% renewable energy goals: Hawaii, California, New Jersey, and New York. Other communities are committing to renewable energy goals through their own local renewable goals for power supply or for installation of renewable energy systems.

As grid penetration of renewable energy systems increases, the need to energy storage systems -- mostly battery storage -- also increases. The Intent section of the IECC should evolve with our societal needs, as by the time this edition is in effect there will be even more renewable energy systems and battery storage systems.

Renewable energy is already explicitly included in the IECC in multiple locations, including, but not limited to: Section C202 Definitions; Section C407.3 Performance-based compliance; Appendix CA Solar Ready Zone; Section R406 Energy Rating Index; Appendix RA Solar Ready Provisions. The Intent section needs to catch up with the provisions within the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

CE3-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The Intent paragraph is sufficient as written and does not need a list of things which address efficient use of energy. The insertion of determining whether the measures in the code or proposed for the code should not be inserted in the Intent statement. (Vote: 9-2)

Assembly Action:

None

CE3-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: R101.3 (IRC N1101.2)

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

Modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* and systems for the effective use and conservation of energy over the useful life of each building, including effective integration of energy efficiency measures, *renewable energy systems*, and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques, ~~including innovative approaches and techniques that achieve the most cost-effective means of compliance to achieve this objective.~~ This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: This proposal and this public comment seeks to include "effective integration of energy efficiency measures, renewable energy systems, and energy storage systems."

This public comment reverts the second sentence back to the same text as found in the 2018 IECC intent section.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

CE5-19 Part I

IECC: Part I: Section C101.3

IECC: Part II: Section R101.3(N1101.2)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for life safety along with the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: There is a misconception among some end users that the energy code is not a life safety code and this is not correct. The energy code either independently or working in conjunction with the other codes assist with several aspects of what is considered the main stream life safety. It assists with tight construction for fire, moisture diffusion within assemblies, and usability during extreme conditions. The intent should identify that this code is promoting life safety as it is stated in the other I-codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change just acknowledges the life safety contribution.

CE5-19 Part I

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C101.3 Intent. This code shall regulate the design and construction of buildings for ~~life safety along with~~ the health, safety, and welfare of the public while regulating the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Committee Reason: Regarding the modification, the committee felt that the change better reflected the intent of the proposal through the use of the phrase 'health, safety and welfare'. It eliminates the perceived conflict with codes that are considered to be 'life safety'. The committee's decision was based on the concept that the IECC already does address health, safety and welfare issues through such regulations including lighting, daylighting and air quality. Making this change is important to make sure designers are keeping those topics in mind as they design under the IECC. The energy code is also an element in long term welfare through the reduction of green house gas emissions and the impacts on climate change. An extreme weather event where access to heating and cooling is lost, an IECC compliant building provides the occupants with better protection. It is not the intent to bring into the IECC regulations which are just health, safety and welfare, but don't have an energy conservation element to them. A public comment to clarify that distinction may be needed. (Vote: 10-5)

Assembly Action:

None

CE5-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: C101.3

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for ~~the health, safety, and welfare of the public while regulating the~~ effective use and conservation of energy over the useful life of each building to protect and promote the public safety, health and general welfare of the public. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: We agree that, like the other I-codes, the IECC is intended to promote the health, safety, and welfare of the public as addressed in CE5p1 as modified by the Committee. However, in our view, CE5 Parts 1 and 2 should be further modified so that the effective use and conservation of energy remains first, since that is the primary objective the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment is largely a clarification of the original proposal and will not increase costs. The required information is already available to the builder at construction, and the builder will only need to make sure that the information is captured on the certificate.

Public Comment# 1431

Public Comment 2:

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests Disapprove

Commenter's Reason: This modification not only excessively and confusingly expands the code's scope into areas it is not designed, by attempting to regulate health, safety and public welfare, but this change also contradicts and discredits the language existing and remaining in the very same section it modifies.

This change unnecessarily and dramatically expands the code's scope beyond energy conservation to also REGULATE "health, safety and welfare of the public". This not only creates significant confusion for building and inspecting officials of which code to look for enforcement of these elements but goes against the language still left in the code which states: that its scope "is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances". Which is it? Is it intended to REGULATE all these elements, which are already appropriately found in other codes, or is it intended to NOT ABRIDGE them? Confusing. This places an undue burden on building officials to look across multiple codes to determine compliance and enforcement for the same regulated elements.

We urge the public vote to disapprove this and not make a headache or mess of all other codes work to be clear and distinct on their specific purpose and scope of what they regulate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1375

Public Comment 3:

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests Disapprove

Commenter's Reason: This is redundant language and is not necessary to add into the intent. The IECC is an energy conservation code focused on conserving energy in buildings without compromising the health and safety of the building which is already addressed in the last sentence of this section that reads "This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances".

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1446

Public Comment 4:

Proponents:

Tim Ryan, International Association of Building Officials, representing IABO

requests Disapprove

Commenter's Reason: One of the primary reasons given for this proposed change is due to the lack of adoptions of the energy code based on the view that the energy provisions are not considered to be related to life safety. There are many factors that impact the adoption of the codes by local and state politicians, i.e., benefit cost ratios, initial costs of construction versus the immediacy of life threatening conditions, etc. We do not believe that merely changing this language will influence local and state politicians to adopt the IECC. To the contrary, it may impact the credibility of the code that will impede adoptions. The proponents gave very little testimony on where life safety is impacted by energy provisions. In fact, the proponent stated in her testimony that the IECC is limited in life safety provisions. Further, the issue of life safety is adequately addressed in the last sentence of Section C101.3. IABO full supports the current intent and adoption of the our energy codes however, we do not subscribe to the thought that energy provisions within the IECC should be elevated to the same level as the life safety requirements within our other codes.

By adding the proposed language it makes the section confusing and substantially changes the scope of the code without supporting testimony. By including this language, it will create confusion within the code development process as to what discipline will be responsible for hearing such changes in the future and eventually create confusion for the enforcement of the code. For these reasons we recommend disapproval of CE5-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1775

CE5-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for life safety along with the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: There is a misconception among some end users that the energy code is not a life safety code and this is not correct. The energy code either independently or working in conjunction with the other codes assist with several aspects of what is considered the main stream life safety. It assists with tight construction for fire, moisture diffusion within assemblies, and usability during extreme conditions. The intent should identify that this code is promoting life safety as it is stated in the other I-codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. This change just acknowledges the life safety contribution.

CE5-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The revision would could have unforeseen consequences in the evaluation of future proposed changes to the IECC. (Vote: 9-2)

Assembly Action:

None

CE5-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: R101.3 (IRC N1101.2)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for life safety along with the effective use and conservation of energy over the useful life of each building to protect and promote the public safety, health and general welfare of the public. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: We agree with the proponent and the Commercial IECC Committee that, like the other I-codes, the IECC is intended to promote the health, safety, and welfare of the public. However, in our view, CE5 Parts 1 and 2 should be further modified so that the effective use and conservation of energy remains first, since that is the primary specific objective the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As this public comment only clarifies the intent statement and clarifications do not affect material or labor costs, the net effect of both the public comment and the proposal has no impact the cost of construction.

Public Comment# 1428

Public Comment 2:

IECC®: R101.3 (IRC N1101.2)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* ~~for life safety along with~~ the health, safety, and welfare of the public while regulating the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: It is important to recognize the IECC as a part of the I-codes family that contain provisions to ensure safety of the occupants.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost effect associated with the recognition of the energy code.

Public Comment# 1206

Public Comment 3:

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests Disapprove

Commenter's Reason: This modification not only excessively and confusingly expands the code's scope into areas it is not designed, (by attempting to regulate health, safety and public welfare) but this change also contradicts and discredits the remaining language in the very same section it modifies.

This change unnecessarily and dramatically expands the code's scope beyond energy conservation to also REGULATE "health, safety and welfare of the public". This not only creates significant confusion for building and inspecting officials of which code to look for enforcement of these elements, but goes against the language still left in the code which states: that its scope "is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances". Which is it? Is it intended to REGULATE all these elements, which are already appropriately found in other codes, or is it intended to NOT ABRIDGE them? Confusing. This places an undue burden on building officials to look across multiple codes to determine compliance and enforcement for the same regulated elements.

We urge the public vote to disapprove this and not make a headache or mess of all other code's work to be clear and distinct on their specific purpose and scope of what they regulate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

CE6-19 Part I

IECC: Part I: Section C101.3

IECC: Part II: Section R101.3(N1101.2)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy primarily for human comfort over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Indeed it remains the intent of the IECC to apply to energy using systems designed primarily for human occupancy (i.e., thermal comfort, visual comfort and service hot-water comfort), and -- unless specifically noted to otherwise -- does not apply to energy using systems designed for commercial, business, educational or industrial processes. This interpretation of the IECC, the Code Council has offered in the past remains the same.

While there remain some direct and indirect inferences to commercial, business, educational or industrial process energy uses throughout the IECC, there exist no "explicit" or "all-inclusive" delineations as to energy end uses designe primarily for humans to live, sleep, eat, work, and play in and around buildings and building sites. Some examples of these direct and indirect inferences to commercial, business, educational or industrial process energy uses, include:

1. C402.1.1 Greenhouses.
2. C402.1.2 [*telecommunications*] Equipment buildings.
3. C403.5 Economizers (Prescriptive), Exception 2; "... spaces designed to be humidified above 35° F (1.7° C) dewpoint temperature to satisfy "process needs."
4. C403.5.4.1 Design capacity; for:
 - o "Systems primarily serving computer rooms ...",
 - o "Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50° F (10° C) dry bulb/45° F (7° C) wet bulb and where 100 percent of the expected system cooling load at 45° F (7° C) dry bulb/40° F (4° C) wet bulb is met with evaporative water economizers."
5. C403.7.1 Demand control ventilation (Mandatory), Exception 5; Ventilation provided only for "process loads."
6. C403.10.1 or C403.10.2 for Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers.
7. C405.3.1 Total connected interior lighting power, Several exemptions:
 - o Lighting for photographic processes,
 - o Lighting for plant growth,
 - o Lighting for food warming, and
 - o Lighting in demonstration equipment for education,
8. C405.4.1 Total connected exterior lighting power, Several exemptions:
 - o Lighting associated with transportation,
 - o Temporary lighting,
 - o Industrial production, material handling and transportation lighting,
 - o Theme element lighting in theme parks.
9. C406.7.1 Load fraction, Exception 2; "Waste heat recovery from ... building equipment, or process equipment."
10. C407.1 Scope; with referent to:
 - o "... receptacle loads and process loads," and
 - o Energy used to recharge or refuel vehicles used for on-road and off-site transportation purposes.

Therefore, as was the case with the 2003 IECC, it is our opinion that niether the 2006 IECC nor it's 2009, 2012, 2015, 2018 or forthcoming 2021 editions are intended to require greenhouses (heated/cooled primarily to preserve the commodity-plants) to meet the envelope provisions of the code.

Section 101.3 the 2006 IECC (our opinion) was inadvertently truncated by the Department of Energy in an effort to improve the utility and enforceability of the IECC vis-a-vis a 'MONSTROUS' scoping and technical content change (see EC48-03/04).

So then, without the proposed language, and interpreted literally, the IECC could indeed be read as limiting the amount of energy put into a blast furnace at a foundry, energy dedicated to civilian booster pumping stations and wastewater treatment facilities keeping our civilian water supply clean, energy to operate fermenting casks at a distillery, energy to run a conveyor at a packaging plant, or even the energy to modulate cabinet temperatures within telecommunication shelters dedicated to switching and signal receiving. However, this is simply not pragmatic and not the case.

Bibliography: A copy of p.1 from the 2003 ICC International Energy Conservation Code.

SECTION 101
GENERAL

101.1 Title. These regulations shall be known as the *Energy Conservation Code* of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

101.2 Scope. This code establishes minimum prescriptive and performance-related regulations for the design of energy-efficient buildings and structures or portions thereof that provide facilities or shelter for public assembly, educational, business, mercantile, institutional, storage and residential occupancies, as well as those portions of factory and industrial occupancies designed primarily for human occupancy. This code thereby addresses the design of energy-efficient building envelopes and the selection and installation of energy-efficient mechanical, service water-heating, electrical distribution and illumination systems and equipment for the effective use of energy in these buildings and structures.

Exception: Energy conservation systems and components in existing buildings undergoing repair, alteration or additions, and change of occupancy, shall be permitted to comply with the *International Existing Building Code*.

101.2.1 Exempt buildings. Buildings and structures indicated in Sections 101.2.1.1 and 101.2.1.2 shall be exempt from the building envelope provisions of this code, but shall comply with the provisions for building, mechanical, service water heating and lighting systems.

101.2.1.1 Separated buildings. Buildings and structures, or portions thereof separated by building envelope assemblies from the remainder of the building, that have a peak design rate of energy usage less than 3.4 Btu/h per square foot (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.

101.2.1.2 Unconditioned buildings. Buildings and structures or portions thereof which are neither heated nor cooled.

101.2.2 Applicability. The provisions of this code shall apply to all matters affecting or relating to structures and premises, as set forth in Section 101. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[EB] 101.2.2.1 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, an existing building envelope, mechanical, service water-heating, electrical distribution or illumination system lawfully in existence at the time of the adoption of this code.

[EB] 101.2.2.2 Additions, alterations or repairs. Additions, alterations, renovations or repairs to a building en-

velope, mechanical, service water-heating, electrical distribution or illumination system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing system to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause any one of the aforementioned and existing systems to become unsafe, hazardous or overloaded.

[EB] 101.2.2.3 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or movement of buildings or structures shall not be mandatory for existing buildings or structures specifically identified and classified as historically significant by the state or local jurisdiction, listed in *The National Register of Historic Places* or which have been determined to be eligible for such listing.

[EB] 101.2.2.4 Change in occupancy. It shall be unlawful to make a change in the occupancy of any building or structure which would result in an increase in demand for either fossil fuel or electrical energy supply unless such building or structure is made to comply with the requirements of this code or otherwise approved by the authority having jurisdiction. The code official shall certify that such building or structure meets the intent of the provisions of law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any increase in demand for either fossil fuel or electrical energy supply or any hazard to the public health, safety or welfare.

101.2.3 Mixed occupancy. When a building houses more than one occupancy, each portion of the building shall conform to the requirements for the occupancy housed therein. Where minor accessory uses do not occupy more than 10 percent of the area of any floor of a building, the major use shall be considered the building occupancy. Buildings, other than detached one- and two-family dwellings and townhouses, with a height of four or more stories above grade shall be considered commercial buildings for purposes of this code, regardless of the number of floors that are classified as residential occupancy.

101.3 Intent. The provisions of this code shall regulate the design of building envelopes for adequate thermal resistance and low air leakage and the design and selection of mechanical, electrical, service water-heating and illumination systems and equipment which will enable effective use of energy in new building construction. It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. This code is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There is no cost implication aligned with this proposal. Rather, it is an exercise steeped in clarification of the IECC Purpose and Scope. The resulting exclusions would mean the process energies assigned to foundries, booster pumping stations, wastewater treatment facilities, distilleries, packaging plants, greenhouses and telecommunication shelters would be "excluded" from the scope and applicability of the IECC, without the need for explicitly articulated lists or exceptions. No change to stringency is proposed.

Public Hearing Results

Committee Reason: The change does not belong in the Intent statement. If provisions of the code should only apply where the concern is human comfort, then specific regulations or exceptions should be placed at those provisions. There was concern that this would be in conflict with actions taken on CE1-19. (Vote: 15-0)

Individual Consideration Agenda

Public Comment 1:

IECC®: C101.3, C401.3 (New)

Proponents:

Darren Meyers, representing Self (dmeyers@ieccode.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy primarily for human comfort over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

C401.3 Car wash buildings. Free-standing and appurtenant manual and automatic car wash facilities or portions thereof separated from the remainder of a building by building thermal envelope assemblies complying with this section, shall be exempt from building thermal envelope provisions of Section C402 and the interior lighting control provisions of Sections C405.2.1, C405.2.2, C405.2.3 and interior lighting power provisions of Section C405.3.

Commenter's Reason: The code does not intend to regulate the commercial process of a car wash facilities as it intends buildings where spaces are heated for human comfort and illuminated for the visual acuity of building occupants (to read, work, eat or play). Moreover, the equipment (applicators, blowers, sprayers, washers, scrubbers and conveyors) utilized for the commercial enterprise of car washing tend to break down, freeze or fail, prematurely if they are not provided with a minimum level of heat for operational performance.

This proposal targets car wash facilities, specifically. The level of space conditioning for a car wash facility is not designed for human comfort, but rather to sustain the commercial enterprise and operational performance of a for-profit car wash facility. Vehicle owners do not need the level of illumination necessary to read, work, eat or play during the 2-5 minutes their vehicle is proceeding through wash cycle. Hence, there is no pragmatic reason to require building insulation, window U-factor/SHGC, air-leakage control, interior lighting power, daylight responsive controls, occupancy/vacancy sensing or interior lighting shut-off control for these facilities.

The IECC Commercial Committee asked the proponent to derive specific language from the more general "human comfort" language for the facilities where application of the IECC is not practical, feasible, or would otherwise encumber commerce.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

There is no cost implication aligned with this proposal. The resulting exclusions would mean the process energies assigned to car wash buildings would be "excluded" from the scope and applicability of the IECC. No change to stringency is proposed.

Public Comment 2:

IECC®: C101.3, C402.1.3 (New)

Proponents:

Darren, International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy ~~primarily for human comfort~~ over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

C402.1.3 Water treatment buildings. Structures surrounding and covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants (including pumping stations and collector systems) and similar facilities not used for human occupancy shall be exempt from building thermal envelope provisions of Section C402.

Commenter's Reason: The code does not intend to regulate facilities harboring the commercial process of water treatment as it intends buildings where spaces are heated for human comfort. Moreover, the equipment (tanks, stirrers, clarifiers, blowers, separators and sprayers, filters and conveyors) utilized for the private and public enterprise of water treatment tend to break down, freeze or fail, prematurely if they are not provided with a minimum level of heat for operational performance.

This proposal targets water treatment, pumping and booster facilities, specifically. There is no pragmatic reason to require building insulation, window U-factor/SHGC, air-leakage control, day-lighting for these facilities.

The IECC Commercial Committee asked the proponent to derive specific language from the more general "human comfort" language for the facilities where application of the IECC is not practical, feasible, or would otherwise encumber commerce.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

There is no cost implication aligned with this proposal. The resulting exclusions would mean the process energies assigned to water treatment buildings would be "excluded" from the scope and applicability of the IECC. No change to stringency is proposed.

Public Comment# 1734

NOTE: CE6-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE6-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for the effective use and conservation of energy primarily for human comfort over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Indeed it remains the intent of the IECC to apply to energy using systems designed primarily for human occupancy (i.e., thermal comfort, visual comfort and service hot-water comfort), and -- unless specifically noted to otherwise -- does not apply to energy using systems designed for commercial, business, educational or industrial processes. This interpretation of the IECC, the Code Council has offered in the past remains the same.

While there remain some direct and indirect inferences to commercial, business, educational or industrial process energy uses throughout the IECC, there exist no "explicit" or "all-inclusive" delineations as to energy end uses designe primarily for humans to live, sleep, eat, work, and play in and around buildings and building sites. Some examples of these direct and indirect inferences to commercial, business, educational or industrial process energy uses, include:

1. C402.1.1 Greenhouses.
2. C402.1.2 [*telecommunications*] Equipment buildings.
3. C403.5 Economizers (Prescriptive), Exception 2; "... spaces designed to be humidified above 35° F (1.7° C) dewpoint temperature to satisfy "process needs."
4. C403.5.4.1 Design capacity; for:
 - o "Systems primarily serving computer rooms ...",
 - o "Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50° F (10° C) dry bulb/45° F (7° C) wet bulb and where 100 percent of the expected system cooling load at 45° F (7° C) dry bulb/40° F (4° C) wet bulb is met with evaporative water economizers."
5. C403.7.1 Demand control ventilation (Mandatory), Exception 5; Ventilation provided only for "process loads."
6. C403.10.1 or C403.10.2 for Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers.
7. C405.3.1 Total connected interior lighting power, Several exemptions:
 - o Lighting for photographic processes,
 - o Lighting for plant growth,
 - o Lighting for food warming, and
 - o Lighting in demonstration equipment for education,
8. C405.4.1 Total connected exterior lighting power, Several exemptions:
 - o Lighting associated with transportation,
 - o Temporary lighting,
 - o Industrial production, material handling and transportation lighting,
 - o Theme element lighting in theme parks.
9. C406.7.1 Load fraction, Exception 2; "Waste heat recovery from ... building equipment, or process equipment."
10. C407.1 Scope; with referent to:
 - o "... receptacle loads and process loads," and
 - o Energy used to recharge or refuel vehicles used for on-road and off-site transportation purposes.

Therefore, as was the case with the 2003 IECC, it is our opinion that niether the 2006 IECC nor it's 2009, 2012, 2015, 2018 or forthcoming 2021 editions are intended to require greenhouses (heated/cooled primarily to preserve the commodity-plants) to meet the envelope provisions of the code.

Section 101.3 the 2006 IECC (our opinion) was inadvertently truncated by the Department of Energy in an effort to improve the utility and enforceability of the IECC vis-a-vis a 'MONSTROUS' scoping and technical content change (see EC48-03/04).

So then, without the proposed language, and interpreted literally, the IECC could indeed be read as limiting the amount of energy put into a blast furnace at a foundry, energy dedicated to civilian booster pumping stations and wastewater treatment facilities keeping our civilian water supply clean, energy to operate fermenting casks at a distillery, energy to run a conveyor at a packaging plant, or even the energy to modulate cabinet temperatures within telecommunication shelters dedicated to switching and signal receiving. However, this is simply not pragmatic and not the case.

Bibliography: A copy of p.1 from the 2003 ICC International Energy Conservation Code.

SECTION 101
GENERAL

101.1 Title. These regulations shall be known as the *Energy Conservation Code* of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

101.2 Scope. This code establishes minimum prescriptive and performance-related regulations for the design of energy-efficient buildings and structures or portions thereof that provide facilities or shelter for public assembly, educational, business, mercantile, institutional, storage and residential occupancies, as well as those portions of factory and industrial occupancies designed primarily for human occupancy. This code thereby addresses the design of energy-efficient building envelopes and the selection and installation of energy-efficient mechanical, service water-heating, electrical distribution and illumination systems and equipment for the effective use of energy in these buildings and structures.

Exception: Energy conservation systems and components in existing buildings undergoing repair, alteration or additions, and change of occupancy, shall be permitted to comply with the *International Existing Building Code*.

101.2.1 Exempt buildings. Buildings and structures indicated in Sections 101.2.1.1 and 101.2.1.2 shall be exempt from the building envelope provisions of this code, but shall comply with the provisions for building, mechanical, service water heating and lighting systems.

101.2.1.1 Separated buildings. Buildings and structures, or portions thereof separated by building envelope assemblies from the remainder of the building, that have a peak design rate of energy usage less than 3.4 Btu/h per square foot (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.

101.2.1.2 Unconditioned buildings. Buildings and structures or portions thereof which are neither heated nor cooled.

101.2.2 Applicability. The provisions of this code shall apply to all matters affecting or relating to structures and premises, as set forth in Section 101. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[EB] 101.2.2.1 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, an existing building envelope, mechanical, service water-heating, electrical distribution or illumination system lawfully in existence at the time of the adoption of this code.

[EB] 101.2.2.2 Additions, alterations or repairs. Additions, alterations, renovations or repairs to a building en-

velope, mechanical, service water-heating, electrical distribution or illumination system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing system to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause any one of the aforementioned and existing systems to become unsafe, hazardous or overloaded.

[EB] 101.2.2.3 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or movement of buildings or structures shall not be mandatory for existing buildings or structures specifically identified and classified as historically significant by the state or local jurisdiction, listed in *The National Register of Historic Places* or which have been determined to be eligible for such listing.

[EB] 101.2.2.4 Change in occupancy. It shall be unlawful to make a change in the occupancy of any building or structure which would result in an increase in demand for either fossil fuel or electrical energy supply unless such building or structure is made to comply with the requirements of this code or otherwise approved by the authority having jurisdiction. The code official shall certify that such building or structure meets the intent of the provisions of law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any increase in demand for either fossil fuel or electrical energy supply or any hazard to the public health, safety or welfare.

101.2.3 Mixed occupancy. When a building houses more than one occupancy, each portion of the building shall conform to the requirements for the occupancy housed therein. Where minor accessory uses do not occupy more than 10 percent of the area of any floor of a building, the major use shall be considered the building occupancy. Buildings, other than detached one- and two-family dwellings and townhouses, with a height of four or more stories above grade shall be considered commercial buildings for purposes of this code, regardless of the number of floors that are classified as residential occupancy.

101.3 Intent. The provisions of this code shall regulate the design of building envelopes for adequate thermal resistance and low air leakage and the design and selection of mechanical, electrical, service water-heating and illumination systems and equipment which will enable effective use of energy in new building construction. It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. This code is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There is no cost implication aligned with this proposal. Rather, it is an exercise steeped in clarification of the IECC Purpose and Scope. The resulting exclusions would mean the process energies assigned to foundries, booster pumping stations, wastewater treatment facilities, distilleries, packaging plants, greenhouses and telecommunication shelters would be "excluded" from the scope and applicability of the IECC, without the need for explicitly articulated lists or exceptions. No change to stringency is proposed.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The term 'human comfort' is not defined. The committee concluded that inserting the term into the Intent statement could affect existing code text and the review of future changes in unforeseen ways. (Vote: 11-0)

Assembly Action:

None

CE6-19 Part II

CE7-19 Part I

IECC: Part I: Section C101.3

IECC: Part II: Section R101.3(IRC N1101.2)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use, conservation, production, and conservation storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Part I:

This proposal updates the intent to account for what is happening at commercial buildings in many parts of the US.

In Section C406.1, one of the options to comply with the "additional efficiency package options" is to add an on-site renewable energy **production** system in accordance with Section C406.5. Renewable energy production systems such as PV panels are a form of energy production, not energy conservation. As a result, the code is now starting to regulate energy production, since there is a minimum requirement in C406.5, and this change should be reflected in the intent of the code.

Also, the growth of energy storage systems, both on the grid side as well as the customer side of the meter, is increasing rapidly. Energy storage systems can be used to help with on-site renewable energy production systems, grid-based renewable energy production systems, or both.

Utilities are now offering commercial customers incentives for installing energy storage systems. Here are links to 2 examples:

<https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-commercial-industrial-buildings-customers/demand-management-incentives> (for Con Edison in New York)

<https://energycenter.org/sgip/incentives> (for SDG&E in California)

As more buildings install renewable energy production systems and energy storage systems, code officials will need to be familiar with the requirements and enforce code requirements.

Part II:

This proposal updates the intent to show that the IECC is now starting to regulate energy production and energy storage systems that are installed in new homes. This update is needed to account for trends in certain areas of the US.

For example, Appendix RB contains requirements for solar-ready provisions installed on single-family homes and townhouses. In Section 406, the Energy Rating Index Compliance Alternative, renewable energy production can be used to obtain a better score. Therefore, the code is now starting to regulate renewable energy production systems that are installed in residential facilities.

Renewable energy systems are a form of energy production, not building energy use. The production of renewable energy does not conserve the amount of energy a building or end-use system or appliance will use. The intent of the code should be updated to account for the recent code changes.

In addition, in California's Title 24, PV energy production systems are now required on new homes (with some exceptions). One of the options with this mandate is to include an on-site energy storage system in the home, as shown below:

From CA Title 24-2019:

"PV sizes from Equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum capacity of 7.5 kWh."

Therefore, code officials will be enforcing the installation of on-site renewable energy production systems, along with the installation of on-site energy storage systems in some cases. This will in addition to enforcing the energy conservation requirements of the energy code.

Bibliography: Part I:

US DOE Better Buildings Program, *On-Site Energy Storage Decision Guide*, April 2017

<https://betterbuildingsolutioncenter.energy.gov/sites/default/files/attachments/BB%20Energy%20Storage%20Guide.pdf>

Part II:

California Energy Commission, "*2019 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS*", December 2018

<https://www.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf>

Cost Impact: The code change proposal will not increase or decrease the cost of construction

In this proposal, the requirements in the code are not being changed. This proposal only clarifies the intent of the energy code to account for what is already occurring in certain building energy codes.

CE7-19 Part I

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use of energy, conservation of energy, production of energy, and storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Committee Reason: The original proposal text was found to be confusing. The modification clarifies that the focus of the intent is only energy; its effective use, conservation, production and storage. The proposal as modified simply speaks to existing provisions of the code which address all these aspects of energy conservation. This allows the use of renewable energy to be a clear intent of the code. (Vote: 8-7)

Assembly Action:

None

CE7-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it adds unnecessary and potentially confusing language to the Intent section of the IECC, which will also distract from the primary purpose of the code -- specifically "the use and conservation of energy."

The IECC-Residential Committee recommended that CE7 Part 2 be disapproved because it was concerned that "production" of energy was not

defined and could be read in a way that expands the scope of the IECC well beyond the building site. The current language, which focuses on the effective use and conservation of energy over the useful life of the building, maintains the proper focus on the building itself and on use and conservation, not production and storage of energy. Just as the code does not list other measures affecting the use and conservation of energy, it should not specifically call out energy production and storage, which would overemphasize what are, at best, secondary considerations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1432

CE7-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for the effective use, conservation, production, and conservation storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Part I:

This proposal updates the intent to account for what is happening at commercial buildings in many parts of the US.

In Section C406.1, one of the options to comply with the "additional efficiency package options" is to add an on-site renewable energy **production** system in accordance with Section C406.5. Renewable energy production systems such as PV panels are a form of energy production, not energy conservation. As a result, the code is now starting to regulate energy production, since there is a minimum requirement in C406.5, and this change should be reflected in the intent of the code.

Also, the growth of energy storage systems, both on the grid side as well as the customer side of the meter, is increasing rapidly. Energy storage systems can be used to help with on-site renewable energy production systems, grid-based renewable energy production systems, or both.

Utilities are now offering commercial customers incentives for installing energy storage systems. Here are links to 2 examples:

<https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-commercial-industrial-buildings-customers/demand-management-incentives> (for Con Edison in New York)

<https://energycenter.org/sgip/incentives> (for SDG&E in California)

As more buildings install renewable energy production systems and energy storage systems, code officials will need to be familiar with the requirements and enforce code requirements.

Part II:

This proposal updates the intent to show that the IECC is now starting to regulate energy production and energy storage systems that are installed in new homes. This update is needed to account for trends in certain areas of the US.

For example, Appendix RB contains requirements for solar-ready provisions installed on single-family homes and townhouses. In Section 406, the Energy Rating Index Compliance Alternative, renewable energy production can be used to obtain a better score. Therefore, the code is now starting to regulate renewable energy production systems that are installed in residential facilities.

Renewable energy systems are a form of energy production, not building energy use. The production of renewable energy does not conserve the amount of energy a building or end-use system or appliance will use. The intent of the code should be updated to account for the recent code changes.

In addition, in California's Title 24, PV energy production systems are now required on new homes (with some exceptions). One of the options with this mandate is to include an on-site energy storage system in the home, as shown below:

From CA Title 24-2019:

"PV sizes from Equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum capacity of 7.5 kWh."

Therefore, code officials will be enforcing the installation of on-site renewable energy production systems, along with the installation of on-site energy storage systems in some cases. This will in addition to enforcing the energy conservation requirements of the energy code.

Bibliography: Part I:

US DOE Better Buildings Program, *On-Site Energy Storage Decision Guide*, April 2017

Part II:

California Energy Commission, "2019 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS", December 2018

<https://www.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf>

Cost Impact: The code change proposal will not increase or decrease the cost of construction. In this proposal, the requirements in the code are not being changed. This proposal only clarifies the intent of the energy code to account for what is already occurring in certain building energy codes.

CE7-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action: **Disapproved**

Committee Reason: The committee concluded that this proposal did not improve the intent statement. They were concerned about the term 'production' which is not defined. The code does not regulate production of power by power utilities. The committee speculated on other terms than production but did not suggest a solution. (Vote: 7-4)

Assembly Action: **None**

CE7-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R101.3 (IRC N1101.2)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for the effective use of energy, conservation of energy, production of energy, and storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: This modification will improve the language by making the intent consistent with the language that was approved for the commercial energy code in CE7-19, Part I. The modified language means the effective use, conservation, production, and storage of energy at the building or building site, not upstream or off-site.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This change to the intent has no new code requirements, and will not have any impact on the cost of construction.

Public Comment# 1288

CE9-19 Part II

IECC@: R102.1

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org)

2018 International Energy Conservation Code

Revise as follows:

R102.1 General. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The *code official* shall have the authority to approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The code official shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code for strength, effectiveness, fire resistance, durability, energy conservation and safety. Where the alternative material, design or method of construction is not *approved*, the *code official* shall respond to the applicant, in writing, stating the reasons why the alternative was not *approved*.

Reason: The purpose of this code change proposal is to help ensure that energy conservation will be considered in any request for approval of alternative materials, designs, or methods of construction. Although the current language of section R102.1/C102.1 requires alternatives to be "not less than the equivalent" of the code requirement for quality, strength, effectiveness, fire resistance, durability, and safety, it is important that the energy conservation impact be considered as well – particularly in the International Energy Conservation Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal merely clarifies that energy conservation must be considered in assessing alternatives to IECC requirements.

Staff Analysis: There is not a coordinate section in IRC Chapter 11, however IRC Section R104.11 covers the subject matter.

CE9-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Initially there was concern that inserting energy conservation in this sentence was simply redundant, but upon further consideration, the committee sees this particular sentence as addressing other topics beyond energy conservation and therefore adding the phrase to the sentence is inappropriate. (Vote: 11-0)

Assembly Action:

None

CE9-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved because it recognizes the obvious – that a material or method must be equivalent in terms of energy conservation if it is to be accepted as an alternative under the energy conservation code. This is consistent with the action of the IECC-Commercial Committee, which approved CE9 Part 1 because the "added text assures that energy conservation is on equal footing in an alternate analysis."

When a code official is considering approval of alternative methods to comply with the energy conservation code, the code official clearly should consider whether the alternative provides adequate/equivalent energy conservation. However, as Section R102.1 is currently written, it is not entirely clear that energy conservation is a part of that consideration at all. With the proposed language, a building code official still has full discretion as to whether the proposed alternative material or design is equivalent in terms of energy conservation, just as the code official must determine whether the alternative is equivalent to the code's requirements for "strength, effectiveness, fire resistance, durability, and safety." But we believe (and the IECC-Commercial Committee agreed) that energy conservation must be included among the list of considerations for the building code official.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. As stated in the original proposal, this proposal merely clarifies that energy conservation must be considered in assessing alternatives to IECC requirements.

Public Comment# 1443

NOTE: CE9-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE9-19 Part I

IECC: Part I: Section C102.1

IECC: Part II: Section R102.1

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C102.1 General. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *code official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability, energy conservation and safety. Where the alternative material, design or method of construction is not *approved*, the *code official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Reason: The purpose of this code change proposal is to help ensure that energy conservation will be considered in any request for approval of alternative materials, designs, or methods of construction. Although the current language of section R102.1/C102.1 requires alternatives to be "not less than the equivalent" of the code requirement for quality, strength, effectiveness, fire resistance, durability, and safety, it is important that the energy conservation impact be considered as well – particularly in the International Energy Conservation Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal merely clarifies that energy conservation must be considered in assessing alternatives to IECC requirements.

CE9-19 Part I

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Approval of alternative methods should determine energy conservation equivalency as well as the other things on this list. The added text assures that energy conservation is on equal footing in an alternate analysis. A public comment to further revise for further consistency with the approved revisions to the Intent statement should be considered. (Vote: 8-7)

Assembly Action:

None

CE9-19 Part I

CE12-19 Part II

IECC: R102.1.1 (IRC N1101.4)

Proposed Change as Submitted

Proponents: Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R102.1.1 (IRC N1101.4) Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified as “mandatory” in Chapter 4 ~~shall be met~~, and the building thermal envelope is greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code.

Reason: Part I:

The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to “above code” programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the “mandatory” measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in residential section R406.

We have followed the approach of section R406 to use the 2009 IECC as a backstop, but we would also support referencing the 2012 IECC. As the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.

Part II

The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to “above code” programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the “mandatory” measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in Section R406. If a minimum backstop is necessary for the ERI, it stands to reason that a minimum backstop would be even more valuable in an even less fully defined and potentially less rigorous “above code” program.

We have proposed the 2009 IECC in this proposal to maintain consistency with the current section R406, but we would also support referencing the 2012 IECC. (We have proposed updating the Section R406 backstop to the 2012 IECC in a separate proposal because we believe that as the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.)

Cost Impact: The code change proposal will not increase or decrease the cost of construction

Because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is far less stringent than the base code requirements, we do not expect any added construction costs as a result.

CE12-19 Part II

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The language is unnecessary for the provisions of above code programs as reflected in testimony on this proposal and previous proposals on this topic. The proposed modification did not provide improvement. (Vote 11-0)

Assembly Action:

None

CE12-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: R102.1.1 (IRC N1101.4)

Proponents:

Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R102.1.1 (IRC N1101.4) Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code where:

1. Such buildings also meet the requirements identified as “mandatory” in Chapter 4; and the building thermal envelope is greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code
2. The proposed total building thermal envelope UA, which is sum of U-factor times assembly area, is less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 1-1; and
3. The area-weighted maximum glazed fenestration SHGC permitted is 0.30 in Climate Zones 1 through 3.

$$UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}} \quad \text{Equation 1-1}$$

Commenter's Reason: This proposal should be approved as submitted or as modified because it establishes an important consumer protection (a thermal envelope backstop) that will help ensure a reasonable level of envelope efficiency in homes that are certified to “above-code programs.” Given the range of programs and program requirements that might be considered as “above-code”, it is critical to ensure that a minimum level of energy efficiency for the thermal envelope is required for compliance under such programs.

While the original proposal is reasonable, we offer the modification above, which applies a more flexible approach to the thermal envelope backstop, based on the approach recommended for approval in RE150-19 for the standard ERI backstop.

Not all voluntary “above-code” programs are created alike. Any program that claims to be above code should achieve greater energy savings overall as compared to the IECC. However, CE12 Part 2 as modified still allows considerable flexibility – the thermal envelope is allowed to be 15% *less efficient* than a home built to the prescriptive code. We think it is reasonable and not onerous for these programs to demonstrate such a minimum level of efficiency as to the thermal envelope in order to be designated as “above-code.”

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is no more stringent than the base code requirements, we do not expect any added construction costs as a result.

Public Comment# 1688

Public Comment 2:

IECC@: R102.1.1 (IRC N1101.4)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R102.1.1 (IRC N1101.4) Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency

program shall be considered to be in compliance with this code where:

1. ~~Such buildings also meet the requirements identified as “mandatory” in Chapter 4; and the building thermal envelope is greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code.~~
2. The proposed total building thermal envelope UA, which is sum of U-factor times assembly area, is less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.4 in accordance with equation 1-1; and
3. The area-weighted maximum glazed fenestration SHGC permitted shall be the SHGC values set forth in Table R402.1.2.

$$UA_{\text{Proposed design}} \leq UA_{\text{Prescriptive reference design}} \quad \text{Equation 1-1}$$

Commenter's Reason: This proposal should be approved as submitted or as modified because it establishes an important consumer protection (a thermal envelope backstop) that will help ensure a reasonable level of efficiency in homes that are certified to “above-code programs.” Given the range of programs and program requirements that might be considered as “above-code”, it is critical to ensure that a minimum level of energy efficiency for the thermal envelope is required for compliance under such programs.

While the original proposal is reasonable, we offer the proposed modification as a further improvement. The proposed backstop in this modification is based on the approach recommended by the Committee for approval in RE150-19 for the standard ERI backstop, but uses current IECC prescriptive values, which is comparable to the ERI backstop that applies where on-site renewable energy is included in the calculation (see Table R406.4 footnote a). We offer this more stringent backstop for this proposal because an above-code program may use solar or other renewable energy as part of its compliance methodology, and therefore should at least achieve the same level of envelope efficiency as required for the ERI.

Not all voluntary “above-code” programs are created alike. Any program that claims to be above code should achieve greater energy savings overall as compared to the IECC. We do not think it is an onerous requirement for these programs to demonstrate a level of efficiency as to the thermal envelope equivalent to the IECC in order to be designated as “above-code.”

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is no more stringent than the base code requirements, we do not expect any added construction costs as a result.

Public Comment# 1692

NOTE: CE12-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE12-19 Part I

IECC: Part I: Section C102.1.1, Chapter 6CE

IECC: Part II: Section R102.1.1(N1101.4)

Proposed Change as Submitted

Proponents: Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C102.1.1 Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered to be in compliance with this code where such buildings meet the requirements identified as “mandatory” in Chapter 4 ~~shall be met.~~ and the *building thermal envelope* is greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table 502.3 and either Table 502.1.2 or 502.2(1) of the 2009 *International Energy Conservation Code* .

Add new text as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

IECC-2009: International Energy Conservation Code

Reason: Part I:

The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to “above code” programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the “mandatory” measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in residential section R406.

We have followed the approach of section R406 to use the 2009 IECC as a backstop, but we would also support referencing the 2012 IECC. As the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.

Part II

The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to “above code” programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the “mandatory” measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in Section R406. If a minimum backstop is necessary for the ERI, it stands to reason that a minimum backstop would be even more valuable in an even less fully defined and potentially less rigorous “above code” program.

We have proposed the 2009 IECC in this proposal to maintain consistency with the current section R406, but we would also support referencing the 2012 IECC. (We have proposed updating the Section R406 backstop to the 2012 IECC in a separate proposal because we believe that as the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.)

Cost Impact: The code change proposal will not increase or decrease the cost of construction because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is far less stringent than the base code requirements, we do not expect any added construction costs as a result.

Analysis: The referenced standard, IECC 2009, is currently referenced in the IECC-R portion of the 2018 IECC.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The proponent asked for disapproval in order to allow him to improve it and to submit a public comment. (Vote: 15-0)

Assembly Action:

None

CE15-19 Part I

IECC: Part I: C103.2.2(New)

IECC: Part II: R103.2 (N1101.5.2.2)(New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Add new text as follows:

C103.2.2 Energy reference construction documents. The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each trade has the option to locate their specific requirements within their section of the construction documents.

Reason: The concept represented in this proposal is not a new concept. Construction plans will place the accessibility requirements and/or fire rated construction requirements on their own sheets with references to them throughout the construction plans. The intent of this proposal is similar to this concept. The intent of this proposal is to assist with gaining compliance with the requirements within this code. Often the requirements are placed intermittently throughout the plans and notes, which are then often inadvertently missed by plans examiners, builders, contractors, and inspectors because of the inconsistent locations they are placed. When placing all of the energy requirements within the construction plans on one or more sheets as needed will allow for the end users to be able to apply the energy requirements the architect, designers, and engineers have designed the project to. The proposal acknowledges that each trade may need to provide their respective energy requirements within their own section of the construction plans, but each trade is still required to provide the information on their sheets.

When everything is placed in one location it becomes easier to verify that all the requirements have been identified. When located in many places throughout the plans often plans examiners will write a review comment that will require the architect/designer to locate it on the plans, write a response to the comments, and take up valuable time for both the architect/designer and plans examiner. This may eliminate the needless review comments because one cannot find the information on the plans, and reduce the time needed to respond by the architect/designer. The idea is to reduce the time needed to get the project through the permitting process. This will allow for those involved with the construction process to install the energy requirements as designed, and allow the inspector to inspect for them.

Cost Impact: The code change proposal will increase the cost of construction

This proposal may increase the cost of construction on the front end with possible additional construction sheets. It may decrease the time in the permitting process which should decrease the cost of construction. It may also decrease the cost of construction for the builders when they are able to comply with the energy requirements and how the project was designed to by decreasing the number of reinspections. Which will also assist with the construction schedule.

CE15-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee found the proposal would be unworkable for larger buildings. For all buildings it would likely result in duplicate information on multiple sheets. This leads to a higher potential for inconsistencies and resulting confusion for plan reviewers, inspectors and subcontractors. Perhaps an index of where information can be found rather than having it duplicated on specific sheets might be explored. (Vote: 13-2)

Assembly Action:

None

CE15-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C103.2.2 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C103.2.2 Energy reference construction documents The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each discipline trade has the option to locate their specific requirements within their specific section of the construction documents.

Commenter's Reason: Having sheets that contain the energy requirements and having them marked as energy sheets will allow the plans examiner a better opportunity to verify that plans are compliant with the energy code in a more timely fashion. These sheets will make it easier for the contractors and builders to be able to install the various energy items as the architect has designed them. This also provides the inspectors a better opportunity to verify that the components of the energy code have been installed correctly and in accordance with how the building/systems were designed for the project.

By providing this information in one location everyone involved has a better opportunity to make sure the building and systems to work together accordingly, as the architect or engineer has designed them to.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost effect associated with the recognition of the energy code.

Public Comment# 1208

CE15-19 Part II

IECC: R103.2.2 (IRC N1101.5.2.2) (New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Add new text as follows:

R103.2.2 (IRC N1101.5.2.2) Energy reference construction documents. The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each trade has the option to locate their specific requirements within their section of the construction documents.

Reason: The concept represented in this proposal is not a new concept. Construction plans will place the accessibility requirements and/or fire rated construction requirements on their own sheets with references to them throughout the construction plans. The intent of this proposal is similar to this concept. The intent of this proposal is to assist with gaining compliance with the requirements within this code. Often the requirements are placed intermittently throughout the plans and notes, which are then often inadvertently missed by plans examiners, builders, contractors, and inspectors because of the inconsistent locations they are placed. When placing all of the energy requirements within the construction plans on one or more sheets as needed will allow for the end users to be able to apply the energy requirements the architect, designers, and engineers have designed the project to. The proposal acknowledges that each trade may need to provide their respective energy requirements within their own section of the construction plans, but each trade is still required to provide the information on their sheets.

When everything is placed in one location it becomes easier to verify that all the requirements have been identified. When located in many places throughout the plans often plans examiners will write a review comment that will require the architect/designer to locate it on the plans, write a response to the comments, and take up valuable time for both the architect/designer and plans examiner. This may eliminate the needless review comments because one cannot find the information on the plans, and reduce the time needed to respond by the architect/designer. The idea is to reduce the time needed to get the project through the permitting process. This will allow for those involved with the construction process to install the energy requirements as designed, and allow the inspector to inspect for them.

Cost Impact: The code change proposal will increase the cost of construction

This proposal may increase the cost of construction on the front end with possible additional construction sheets. It may decrease the time in the permitting process which should decrease the cost of construction. It may also decrease the cost of construction for the builders when they are able to comply with the energy requirements and how the project was designed to by decreasing the number of reinspections. Which will also assist with the construction schedule.

CE15-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal would result in a significant burden on the architect to provide additional sheets. Such sheets may result in redundant information in the submitted paperwork and increases the possibility of conflict within the documents. It is unclear what is really required. (Vote: 8-3)

Assembly Action:

None

CE15-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: R103.2.2 (IRC N1101.5.2.2) (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R103.2.2 (IRC N1101.5.2.2) Energy reference construction documents The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each discipline trade has the option to locate their specific requirements within their section of the construction documents.

Commenter's Reason: Having sheets that contain the energy requirements and having them marked as energy sheets will allow the plans examiner a better opportunity to verify that plans are compliant with the energy code in a more timely fashion. These sheets will make it easier for the contractors and builders to be able to install the various energy items as the architect has designed them. This also provides the inspectors a better opportunity to verify that the components of the energy code have been installed correctly and in accordance with how the building/systems were designed for the project.

By providing this information in one location everyone involved has a better opportunity to make sure the building and systems to work together accordingly, as the architect or engineer has designed them to.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no cost effect associated with the recognition of the energy code.

Public Comment# 1209

CE16-19 Part I

IECC Part I: C105.4, C105.4.1(New), C105.4.2(New), C105.4.3(New)

IECC Part II: R105.4, R105.4.1(New), R105.4.2(New), R105.4.3(New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

SECTION C105 INSPECTIONS

Revise as follows:

C105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the building components and systems that they are inspecting.

Add new text as follows:

C105.4.1 Authorization of approved third-party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance inspections, the agency shall be authorized as a third-party extension of the code official to verify compliance.

C105.4.2 Approved third-party inspections agreement. The third-party inspection agency and the code official shall agree upon which compliance verification measures will be incorporated within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from C401.2.

C105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

Reason: In relation to the International Energy Conservation Code, third-party inspection agencies and building officials currently have a variety of ideas regarding what should constitute the work of the agency. For the ERI path, for example, many Raters understand that they must develop an ERI score, but do not fully understand their relationship to inspection of the mandatory requirements of the IECC. Jurisdictions having authority, are often either abdicating inspections or believe that Rater's are looking at mandatory inspection items. In addition, the creation of a HERS Index score is different from the creation of an ERI score. A HERS Index score is an asset rating which allows for the derating of the R-value of poorly installed insulation in the energy model, as the objective is to benchmark the energy performance of the home on the HERS Index scale. An IECC ERI evaluation of the installation of Insulation does not allow for the derating of poorly installed insulation. If insulation is not installed in accordance with the manufactures instruction and the guidance given in table R402.4.1.1, then the installation should fail inspection and be reinstalled until it meets the mandatory requirement of the code. This disconnect in understanding is the genesis of this code change proposal.

Building on the charging language of the approved inspection agency this proposal makes it clear that the inspection agency is third party. This proposal states that when acting as a third party the agency is actually acting as an extension of the jurisdiction having full delegated authority in order to better ensure there is no confusion between the project owner and their construction representatives on site. The most important part of this proposed language is the requirement to create a scope of work that defines the relationship between the third-party inspection agency and the authority having jurisdiction. Ultimately neither identity can rely on assumptions, and this proposal requires a level of coordination and dialog that is not overly burdensome yet extremely important.

As with the outlined special inspections of the IBC, the proposal ends by demonstrating to the project owner and their representative that defined inspection must occur either through the authority having jurisdiction or the approved third-party inspection agency and that the construction schedule can not proceed with subsequent phases of construction until all sequential inspections take place and pass. Lastly, the proposal seeks documentation that all approved inspections occurred and meet the intent of the code.

The clarity gained in the relationship between the authority having jurisdiction and the approved third-party inspection agency is crucial as we progress into more complicated and meaningful energy codes. Nationally, jurisdictions are losing experienced professionals to retirement. Consequently, more third-party inspection agencies are stepping in to fill the gap. These third-party inspection agencies tend to be solely focused on energy and are capable, and eager to work in the energy code compliance niche. They are filling a need for jurisdictions that are either under staffed or lack a desire to fully enforce the energy components of the code. This proposal clearly defines a path forward to meet the need by defining scope and responsibilities to better ensure compliance and thus achieve expected energy savings.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the authority having jurisdiction.

CE16-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: While it attempts to define the relationship between code official and third parties, the committee believed that it doesn't belong in the code. It might be better as a jurisdiction's guidance documents. This would constrain the code official's relationship with such third parties. (Vote: 10-4)

Assembly Action:

None

CE16-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION C105, C105.4, C105.4.1 (New), C105.4.2 (New), C105.4.3 (New)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION C105 INSPECTIONS

C105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the building components and systems that they are inspecting or testing.

C105.4.1 Authorization of approved third-party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance inspections, the agency shall be authorized as a third-party extension of the code official to verify compliance.

C105.4.2 Approved third-party inspections scope agreement. ~~The third-party inspection agency and the code official shall determine and communicate agree upon which compliance verification measures the third party inspection agency will be shall incorporate d within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from G401.2.~~

C105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

Commenter's Reason: Public Comment Reason Statement

Per the committee's guidance, this proposal was streamlined to better point to specific aspects of the relationship between approved third-party inspection agencies and the code official. There are three aspects of the relationship that are specifically troublesome within the context of IECC enforcement and which this proposal addresses.

1. Assurance that a transfer of authority is established so that a third-party inspection agency is authorized to fail or pass the inspections they perform and that the party being inspected clearly understands that authority.
2. As the committee noted, the code official must clearly establish what is needed from the third-party inspection agency. R105.4.2 above has

been significantly changed to address the committee's comment. Now the section establishes a scope rather than an agreement and rightfully requires the code official to dictate the nature of the scope of work needed.

3. Lastly, anything inspected by a third-party agency must be reported to the code official and the owners representative

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the Code official.

Public Comment# 1764

CE16-19 Part II

IECC: R105.4, R105.4.1 (New), R105.4.2 (New), R105.4.3 (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION R105 INSPECTIONS

Revise as follows:

R105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting.

Add new text as follows:

R105.4.1 Authorization of approved third- party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance inspections, the agency shall be authorized as a third-party extension of the code official to verify compliance.

R105.4.2 Approved third-party inspections agreement. The third-party inspection agency and the code official shall agree upon which compliance verification measures will be incorporated within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from R401.2.

R105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

CE16-19 Part II

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal requires the code official to agree with the contractor regarding the scope of work. As the code official establishes what is needed from the 3rd party, it is the code official who decides the scope of work regardless of agreement, or not, of the contractor. (Vote: 11-0)

Assembly Action:

None

CE16-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION R105, R105.4, R105.4.1 (New), R105.4.2 (New), R105.4.3 (New)

Proponents:

Robert Schwarz, representing Colorado Chapter of the ICC (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R105 INSPECTIONS

R105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting or testing.

R105.4.1 Authorization of approved third-party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance ~~inspections~~, the agency shall be authorized as a third-party extension of the code official to verify compliance.

R105.4.2 Approved third-party inspections scope, agreement. ~~The third-party inspection agency and the code official shall determine and communicate agree upon which compliance verification measures the third party inspection agency will be shall incorporate incorporated within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from C401.2.~~

R105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

Commenter's Reason: Public Comment Reason Statement

Per the committee's guidance, this proposal was streamlined to better point to specific aspects of the relationship between approved third-party inspection agencies and the code official. There are three aspects of the relationship that are specifically troublesome within the context of IECC enforcement and which this proposal addresses.

1. Assurance that a transfer of authority is established so that a third-party inspection agency is authorized to fail or pass the inspections they perform and that the party being inspected clearly understands that authority.
2. As the committee noted, the code official must clearly establish what is needed from the third-party inspection agency. R105.4.2 above has been significantly changed to address the committee's comment. Now the section establishes a scope rather than an agreement and rightfully requires the code official to dictate the nature of the scope of work needed.
3. Lastly, anything inspected by a third-party agency must be reported to the code official and the owners representative

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the Code official

CE19-19 Part II

IECC: R202 (IRC N1101.6), ASTM Chapter 6

Proposed Change as Submitted

Proponents: Donald Sivigny, State of Minnesota, representing State of MN and Association of Minnesota Building Officials
(don.sivigny@state.mn.us)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Revise as follows:

AIR-IMPERMEABLE INSULATION. An Insulation that functions as an air barrier material having an air permeance equal to or less than 0.02L/s=
m² at 75 Pa pressure differential as tested in accordance with ASTM E2178 or E283.

ASTM

Add new standard(s) as follows:

ASTM E2178-13 Standard Test Method for Air
Permanence of Building Materials

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

Reason: *This Change is done to simply to combine and utilize the language of the IRC and IECC definitions together for consistency, and accuracy as to what Air Impermeable Insulation must meet to reduce both, air infiltration and exfiltration. This definition will create better enforcement and understanding of the code by providing a test standard and because the definition in Section N1101.6 is incomplete, and creates confusion for both the builder and the code official.*

(Note: The Definition in Section N1101.6 should also be removed in favor of the definition as will now be written and out of IRC Chapter 2)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change simply better defines Air-Impermeable insulation by combining the definitions from the IECC and IRC together for consistency and uniformity.

Staff Analysis: The referenced standard, ASTM E2178-13, is currently referenced in the 2018 IECC-Commercial Provisions.

CE19-19 Part II

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: While the proposal puts a technical threshold within the definition, it is not strictly regulatory. The technical provision is needed to establish the threshold for material to be considered air impermeable insulation. (Vote: 8-3)

Assembly Action:

None

CE19-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: , R303.1.5 (N1101.10.4) (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

AIR-IMPERMEABLE INSULATION. An insulation that functions as an air barrier material having an air permeance equal to or less than 0.02 L/s·m² at 75 Pa pressure differential as tested in accordance with ASTM E2178 or E283.

R303.1.5 (N1101.10.4) Air-Impermeable insulation Insulation having an air permeability not greater than 0.004 cfm/ft² (0.002 L/s·m²) under pressure differential of 0.3 inch water gauge (75 PA) when tested in accordance with ASTM E2178 shall be determined air-impermeable insulation.

Commenter's Reason: The definition is not the correct location to place technical provisions, but this proposal does have some merit for the Residential provisions of the IECC and Chapter 11 of the IRC. I think the correct location for this information is in Chapter 3 that contains other testing requirements to determine the rating of various products i.e. insulation r-value, fenestration u-factor, or fenestration SHGC. The testing criteria were altered to reflect the air impermeable criteria found in the commercial provisions of this code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment relocates the original proposal's clarification (a definition) as to what constitutes "air-impermeable insulation, to a better location in the code. Clarifications to the code do not impact construction cost as additional material or labor is not required by a clarification.

Public Comment# 1782

Public Comment 2:

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests Disapprove

Commenter's Reason: As stated in the Committee's disapproval for Part I, the added technical provision shouldn't be in the definition, but instead in the appropriate section of the code. Additionally, this proposal may set up a conflict of a material test (ASTM E2178) versus an assembly test (ASTM 283).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 2035

NOTE: CE19-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE19-19 Part I

IECC: Part I: C202(New)

IECC: Part II: R202 (N1101.6); Chapter 6RE(New)

Proposed Change as Submitted

Proponents: Donald Sivigny, State of Minnesota, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

AIR-IMPERMEABLE INSULATION. An Insulation that functions as an air barrier material having an air permeance equal to or less than $0.02L/s=m^2$ at 75 Pa pressure differential as tested in accordance with ASTM E2178 or E283.

Reason: *This Change is done to simply to combine and utilize the language of the IRC and IECC definitions together for consistency, and accuracy as to what Air Impermeable Insulation must meet to reduce both, air infiltration and exfiltration. This definition will create better enforcement and understanding of the code by providing a test standard and because the definition in Section N1101.6 is incomplete, and creates confusion for both the builder and the code official.*

(Note: The Definition in Section N1101.6 should also be removed in favor of the definition as will now be written and out of IRC Chapter 2)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change simply better defines Air-Impermeable insulation by combining the definitions from the IECC and IRC together for consistency and uniformity.

Analysis: The referenced standard, ASTM E2178-2013, is currently referenced in other 2018 I-codes.

CE19-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The definition includes a technical provision that this committee felt shouldn't be in the definition, but instead in the appropriate section of the code. It may set up a conflict of a material test versus an assembly test. (Vote: 13-2)

Assembly Action:

None

CE19-19 Part I

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

BIOMASS GAS. A medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill.

BIOMASS WASTE. Organic non-fossil material of biological origin that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and gases; but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol.

Revise as follows:

ON-SITE RENEWABLE ENERGY. Energy derived from solar radiation, wind, waves, tides, ~~landfill biomass gas, biogas, biomass waste or the internal heat of the~~ extracted from hot fluid or steam heated within the earth. The energy system providing on-site renewable energy shall be located on the ~~project building~~ site.

Reason: The existing definition in IECC dates to the 2012 IECC. It was proposed by the team of New Buildings Institute, US Department of Energy and American Institute of Architects. It was one clause in a comprehensive overhaul of the 2009 IECC. When it was written in 2010, it was the first time that renewable energy had been defined in an I-code, and it reflected a very early understanding of a much less mature industry. It has not been significantly revised since.

This proposal does indeed update the language by further refining biomass energy sources with terms that were not available at the time it was drafted in 2010. Revised language makes the proper distinction between geothermal energy sources and geothermal heat pumps. The revision also limits the biomass sources to those that meet specifications as waste products. There are many flavors of biomass energy, but this proposal ensures that virgin material of unknown origin is not used as a steady source of energy, which in the provisions of C406 is a trade-off for energy efficiency features of the building. The definitions of *biomass gas* and *biomass waste* are taken from the glossary of the Energy Information Administration.

This proposal does not restrict the geographic sourcing of the waste material, but it does ensure that the system converting the fuel is located on the building site.

This proposal impacts and clarifies only the "landfill gas, biogas and biomass" terms in the on-site renewable definition. It is independent of another proposal to restructure and revise other terms in the same definition.

Bibliography: U.S. Energy Information Administration Glossary; <https://www.eia.gov/tools/glossary/>

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal is a definition of renewable energy that will no have an impact on construction costs. The modification of the definition only applies only to the fuel used after occupancy.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The definition may conflict with state and federal rules on these topics. CE31-19 adequately addresses the topic. (Vote 15-0)

Assembly Action:

None

CE21-19

Individual Consideration Agenda

Public Comment 1:

IECC@: 202, (New)

Proponents:

jim edelson, representing New Buildings Institute (jim@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

ON-SITE RENEWABLE ENERGY. Energy derived from solar radiation, wind, waves, tides, ~~biomass gas, biogas,~~ biomass waste or extracted from hot fluid or steam heated within the earth. The energy system providing on-site renewable energy shall be located on the ~~building~~ project site.

BIOMASS GAS. ~~A medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill mixture of hydrocarbons that is a gas at 60 degrees Fahrenheit and 1 atmosphere of pressure that is produced through the anaerobic digestion of organic matter.~~

BIOMASS WASTE. Non-fossilized and biodegradable organic material originating from plants, animals and/or micro-organisms, including products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material. ~~that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and gases; but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol.~~

Commenter's Reason: The existing definition of onsite renewable energy in IECC dates back to the 2012 IECC. It does not provide any qualifications for two generic terms in the definition – biomass and biogas. The proposed definitions are taken from U.S. Government sources. Adding these definitions will provide projects and code officials clear guidance for determining what qualifies as biomass and biogas for the purposes of IECC compliance.

Bibliography: U.S. Code of Federal Regulations; 40 CFR § 80.1401 - Definitions

U.S. Environmental Protection Agency; <https://www3.epa.gov/carbon-footprint-calculator/tool/definitions/biomass.html>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

“As this public comment only clarifies the proposed definitions and clarifications do not affect material or labor costs, thus the net effect of both the public comment and the proposal will not impact the cost of construction.”

Public Comment# 2085

CE35-19

IECC: C202

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Revise as follows:

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Reason: The current definition of above-grade wall is general and vague and allows for an interpretation that ignores the thermal performance of important building elements. For example, the existing definition is not clear that exposed floor edges are part of the above-grade wall. Depending on how the code is interpreted/enforced, this could leave this building element unregulated.

This change to the definition clarifies it and closes this potential loophole. It is explicitly clear that the critical elements of a building that function as part of the wall component of the thermal envelope, even though they may not be thought of as walls, are regulated as walls. These elements will need to be either insulated to meet the above-grade wall requirements or be incorporated into weighted averages for the performance of the above-grade wall.

The language was drawn from the definition currently used in the WA state energy code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This modification clarifies the code and should not increase the cost of construction.

CE35-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Committee Reason: The modification removes terminology unique to the residential provisions of the code. The revisions brings needed clarity to the term and its application. The testimony was a good example of how the existing term is variously interpreted. (Vote 15-0)

Assembly Action:

None

CE35-19

Individual Consideration Agenda

Public Comment 1:

IECC®: 202

Proponents:

Tien Peng, representing NRMCA (tpeng@nrmca.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, ~~peripheral edges of floors~~, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Commenter's Reason: While there is a need to consider the "peripheral edges of floors", treating this element as the same as the "Above Grade Wall" for concrete slabs is not practical with current technology. Instead of eliminating the thermal bridging, we should act to enable the current range of manufactured thermal breaks (up to R-5) technology as the cost effective solution.

Bibliography: *The Importance Of Balcony And Slab Edge Thermal Bridges In Concrete Construction*, G. Finch, MASc., et. al., RDH Building Engineering. 2013. The Importance of Slab Edge and Balcony Thermal Bridges, Reports. Available at www.rdh.com.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction According to the RDH Building Engineering study presented at the 14th Canadian Conference on Building Science and Technology, the cost for the manufactured thermal breaks (up to R-5) is \$38-60/ft. This is an amount greater than what the proponent claimed as no affect on construction cost so this PC is decreasing the cost.

Public Comment# 2099

Public Comment 2:

IECC@: 202

Proponents:

Martha VanGeem, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, ~~peripheral edges of floors~~, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Commenter's Reason: We ask that the phrase "peripheral edges of floors" be removed from the definition of above grade wall. When cost effectiveness for wall insulation was prepared for the IECC and ASHRAE 90.1, it was not prepared for the peripheral edges of floors. It was prepared for the clear field portion of walls which is the portion of the walls between floors and between columns and taking into account studs or fasteners in this region.

Insulating the edges of floors can be more expensive than insulating walls because they are smaller edges and have fire proofing requirements, and this was not taken into account in the cost effectiveness of the wall insulation. In addition, floor edges cannot utilize interior insulation, which is often the least expensive method for insulating for mass walls. The cost of a weather resistant material outboard of the slab insulation has also not been included. It is my understanding that some areas of the Pacific NW require slab edge insulation, but only R3 or R5 is required rather than the full amount of wall insulation. This insulation might be traded off (not used) with COMCheck, but it would be better to tell the owner/contractor/code official what exactly is required prescriptively and not presume they use COMCheck. Some building owners and contractors just want to know what to do to comply and therefore need reasonable prescriptive requirements. Code officials need to know what compliance looks like.

It is also not clear as to how balconies would be handled and whether they are peripheral edges of floors. If they are, how are they supposed to be insulated? Without this modification, the definition of wall is not clear.

This proposal will increase the cost of construction whereas the proposal said it would not. Cost effectiveness was not provided especially for the case of peripheral edges of floors. These floor edges are not specifically addressed in the current code, and where there are new R-value requirements, cost justification should be provided.

Therefore, we ask that "peripheral edges of floors" be deleted until more cost justification is provided.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The cost impact statement in the original proposal is incorrect as the "included" construction elements will require insulation which adds materials and labor. This public comment removes one item from the "included" list so there will not be added costs for insulating that item. As such, in the larger picture of many building projects, this public comment slightly reduces the cost increase of the original proposal because only some projects will have that particular construction detail. However, the net effect of both (public comment and proposal) is still an increase in the cost of construction.

Public Comment# 1284

Public Comment 3:

Proponents:

Emily Lorenz, PCI, representing PCI (emilyblorenz@gmail.com)

requests Disapprove

Commenter's Reason: Asking for disapproval for the following reasons:

Particularly for peripheral edges of floors, when cost effectiveness for wall insulation was prepared for the IECC and ASHRAE 90.1, it was not prepared for the peripheral edges of floors. It was prepared for the clear field portion of walls, which is the portion of the walls between floors and between columns, and it takes into account studs or fasteners in this region.

Insulating the edges of floors can be more expensive than insulating walls because they are smaller edges and have fire proofing requirements, and this was not taken into account in the cost effectiveness of the wall insulation. In addition, floor edges cannot utilize interior insulation, which is often the least expensive method for insulating mass walls, and the cost of a weather resistant material outboard of the slab insulation has also not been included.

It is my understanding that some areas of the Pacific NW require slab edge insulation, but only R3 or R5 is required rather than the full amount of wall insulation. This insulation might be traded off (not used) with COMCheck, but it would be better to tell the owner/contractor/code official what exactly is required prescriptively and not presume they use COMCheck.

It is also not clear as to how balconies would be handled and whether they are peripheral edges of floors. If they are, how are they supposed to be insulated?

This proposal will increase the cost of construction whereas the proposal said it would not. Cost effectiveness was not provided especially for the case of peripheral edges of floors. These floor edges are not specifically addressed in the current code, and where there are new R-value requirements, cost justification should be provided.

Therefore, we ask for disapproval until more cost justification is provided.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The net effect of a Disapprove action is that the code will not be changed, therefore there are no potential cost impacts.

Public Comment# 1828

CE43-19

IECC: C401.2, Chapter 6CE (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of ANSI/ASHRAE 90.4 for Data Centers.
3. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
4. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Add new text as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329

90.4-16: Energy Standard for Data Centers-

Reason: ASHRAE Standard 90.4, *Energy Standard for Data Centers*, was published in 2016 and is on continuous maintenance. It establishes the minimum energy efficiency requirements of data centers for design and construction and for creation of a plan for operation and maintenance, and for utilization of on-site or off-site renewable energy resources.

Data center applications are unlike their commercial building counterparts in two significant ways. First, they include significantly higher plug loads (e.g., computer servers and UPS equipment). Second, they employ rapidly changing technology for the IT equipment and associated power/cooling approaches.

There is also a recognition that current industry modeling tools do not possess all the necessary mathematical models to accurately and appropriately model data center HVAC and electrical equipment design. As a result, demonstrating compliance to the 90.1 Chapter 11 or energy cost budget (ECB) approaches is usually impractical.

Along with ASHRAE 90.1, designers and owners of data centers should have the option to use ANSI/ASHRAE 90.4 as a compliance path.

Bibliography: American Society of Heating, Refrigeration, and Air Conditioning Engineers, *Energy Standard for Data Centers*, July 2016. https://www.techstreet.com/ashrae/standards/ashrae-90-4-2016?product_id=1922463

Cost Impact: The code change proposal will increase the cost of construction
This proposal increases the costs of data centers due to its higher efficiency requirements.

Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.4, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

CE43-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This may provide an incomplete solution for managing data in energy centers, and does not belong in C401.2. The code does not have a definition of data center or know what version of 90.4 is included (Vote: 14-1).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: 202 (New), C401.2, C401.3 (New), ASHRAE Chapter 06 (New)

Proponents:

Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (rosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

DATA CENTER. A room or building, or portions thereof, including computer rooms being served by data center systems, serving a total information technology equipment load greater than 10 kiloWatts and 20 Watts/ft² (215 Watts/m²) of conditioned floor area.

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
- ~~2. The requirements of ANSI/ASHRAE 90.4 for Data Centers.~~
- ~~3.2.~~ The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
- ~~4.3.~~ The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C401.3 Application to data centers. Data centers shall be allowed to comply with the requirements of ANSI/ASHRAE 90.4.

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329

90.4- 2016: Energy Standard for Data Centers

Commenter's Reason: This proposal addresses the concerns of the committee by making the following changes:

- It moves the language out of Section C401.2 and into a new section C401.3 to ensure that it only applies to data centers.
- It adds a definition of data center that is technically consistent with the definition of data centers in ANSI/ASHRAE Standard 90.4.
- It makes an editorial change to the standard reference (changing "16" to "2016").

Bibliography: ASHRAE

90.4-2016: Energy Standard for Data Centers

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal and public comment will increase the cost of construction. The code change proposal (and public comment) increases the cost of data centers due to efficiency requirements in the 2016 version of the standard.

Public Comment# 1241

Public Comment 2:

Proponents:

Colin Laisure-Pool, MPSW, Inc., representing Self (clpool@gmail.com)

requests As Submitted

Commenter's Reason: I'd like to express support for this proposal, as revised/submitted by Steven Rosenstock. ASHRAE 90.4-2016 is a comprehensive standard regarding data centers that defines what specifically is being focused on, and provides helpful informative notes, tables, and example calculations. Simply copy/pasting the efficiency tables leaves out important context that will undoubtedly lead to confusion among designers and AHJs. See the following:

2018 International Energy Conservation Code

C401.2 Application. Commercial buildings shall comply with one of the following:

1. **The requirements of ANSI/ASHRAE/IESNA 90.1.**
2. **~~The requirements of ANSI/ASHRAE 90.4 for Data Centers.~~**

~~3.~~ 2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

~~4.~~ 3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Add new text as follows: C401.3 Application to *Data Centers*.

Data Centers shall be allowed to comply with the requirements of ANSI/ASHRAE 90.4-2016 Energy Standard for *Data Centers*

SECTION C202 GENERAL DEFINITIONS

DATA CENTER. A room or building, or portions thereof, including *computer rooms* being served by *data center* systems, serving a total information technology equipment load greater than 10 kiloWatts and 20 Watts/ft² (215 Watts/m²) of *conditioned floor area*.

Bibliography: ASHRAE 90.4 - 2016

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Any required increase in HVAC or Electrical system efficiency will tend to increase the initial cost of construction.

Public Comment# 1278

CE44-19

C401.1, C401.2, RE RESNET Ch 6

Proposed Change as Submitted

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc., representing Steven Winter Associates, Inc. (gayathri@swinter.com); Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

C401.1 Scope. The provisions in this chapter are applicable to commercial buildings and their building sites.

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

Exception: Dwelling units and sleeping units in Group R-2 buildings shall be deemed to be in compliance with this chapter provided they comply with Section R406.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

RESNET

Residential Energy Services Network, Inc.
P.O. Box 4561
Oceanside, CA 92052-4561

ANSI/RESNET/ICC ~~301—2014~~ 301—2019: Standard for the Calculation and Labeling of the Energy Performance of Low-rise Residential Buildings Dwelling and Sleeping Units using an Energy Rating Index First Published March 7, 2014—Republished January 2016 Index

Reason: Multifamily buildings (Group R-2) have historically been split between the residential and commercial provisions of the IECC, based on their height, resulting in very different compliance requirements for similar buildings. Prior change proposals seeking to provide consistency for this building type have struggled to find a simple approach. This proposal provides a simple optional alternative for dwelling and sleeping units within these “commercial buildings” to instead meet the same energy efficiency requirements of dwelling and sleeping units under the Residential provisions, specifically section R406, the Energy Rating Index Compliance Alternative. This section R406 still requires compliance with mandatory items, including but not limited to those listed in sections R401 through R404. The other spaces in the building, such as corridors, stairwells, lobbies, community spaces, and sometimes, retail, still are required to comply with the commercial provisions. While this proposal was not possible before now, ANSI/RESNET/ICC 301-2019, which is the Standard for calculating the ERI, has recently expanded its scope to include dwelling and sleeping units in any height building, which means those units in ‘commercial buildings’ are now eligible for an ERI. While efficiency requirements can vary for the same building components, whether you are in the Residential or Commercial provisions, this is the 1st step in providing dwelling units in multifamily buildings the same path to code compliance, regardless of their building height. This results in a dwelling unit in a 3 story building and the same exact dwelling unit in a 4 story building to both be deemed code compliant, with the same exact building components.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The cost impact depends on the code compliance currently being followed.

For those doing building simulations in accordance with C407, this may present a decrease in the costs to demonstrate compliance.

Those not choosing this alternative will experience no change in costs.

Those choosing this alternative will likely do so if they are able to utilize the same energy rating index being used in other multifamily programs, such as ENERGY STAR and LEED, or utility-sponsored incentive programs that require an ERI, as their code compliance option. This will also therefore result in no additional costs.

Staff Analysis: The proposal is dependent upon the RESNET standard referenced in R406 being updated as shown.

CE44-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: There are concern for combining combining compliance paths and it being used to create a loophole in high rise buildings. It would not apply to buildings with central heat and water. There are too many questions about equivalency, difference between HERS and ERI. There is no cost data, and other performance paths available. There were clear examples of when it wouldn't work, and questions of applicability (Vote: 13-2).

Assembly Action:

None

CE44-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C401.1, C401.2

Proponents:

Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C401.1 Scope. The provisions in this chapter are applicable to commercial buildings and their building sites.

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
~~Exception—Dwelling units and sleeping units in Group R-2 buildings that comply with Section R406 shall be deemed to be in compliance with this chapter provided they comply with Section R406.~~
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Commenter's Reason: While I am a proponent of this code change proposal, the edits shown in this public comment are the result of working with ICC staff on a floor mod prior to the CAH to make the wording more clear that this code change proposal introduces an option and not a mandatory requirement.

I was not present at the CAH during testimony on CE44 and therefore missed the opportunity to answer some important questions that were raised. Upon viewing the 26 minutes of testimony, I am using this public comment to correctly answer those questions and address the concerns raised. As the current Chair of RESNET SDC300 tasked with revising and developing ANSI 301-2019 and also a mechanical engineer, ASHRAE Building Energy Modeling Professional (BEMP), and a HERS Rater, I am well positioned to answer these questions. I also do not represent RESNET on this proposal.

The Committee's concerns were noted in the Reason statement above, which I copied and addressed below.

1. **"There are concerns for combining compliance paths."** Multifamily buildings under Residential code deal with this already where the units are subject to Residential provisions and the non-dwelling spaces are subject to the Commercial provisions. Even throughout the code there are specific items that re-direct dwelling units from commercial code back to residential code (ie. lighting, C405.1) or send HVAC systems from Residential to Commercial (R403.8). Multifamily buildings are caught between the two codes and this code change proposal was finally providing them a

streamlined option, where a 3 story MF could reach code compliance in the same exact way as a 4 story MF. In practice, code compliance would use the same compliance reports that are used in R406 for the dwelling units and COMCheck that is typically used for the commercial building, would be used for the non-dwelling spaces.

2. **"...and it being used to create a loophole in high rise buildings."** A loophole implies that less stringent requirements are being met by choosing this option. The option being chosen is in fact already deemed to be a code compliant path for residential MF in the IECC. The reason we have different requirements is because at some point code arbitrarily split MF at 4 stories. The ERI Path will generally result in more stringent requirements, not just because it requires air leakage tests, but it also uses a Reference Design which will have in-unit systems (ie. SEER 13 AC, 78% AFUE furnace, 80% boiler), with no energy allowance for central pumping energy. In contrast, ASHRAE 90.1 Appendix G, depending on climate zone, assumes a central boiler with pumping power to serve HW PTAC's. There would be no advantage for a high-rise to switch to the ERI Path. Same for curtainwall buildings. While not explicitly limited to a % window area when following R406, the ERI Reference Design has a cap (~18%) and the climate zone permitted ERI's were not based on that building type. Ask any Rater if they could build an ERI model for an apartment with curtainwall and easily get below 57. And similar to ASHRAE 90.1 Appendix G, the Reference Design is NOT intended to reflect the same values in the Commercial provisions, which is why the proposal didn't provide that comparison. Both ERI and 90.1 landed on needing a stable baseline and to instead adjust the % better than the baseline as the means to attain higher energy efficiency (The Baseline in 90.1 landed on 2004 levels and ERI Reference is roughly 2006 IECC). See Table 4.2.2(2) of ANSI 301-2019 for specific envelope values. Again, ask any Rater how "easy" it is to get to ERI of 57-62. The answer generally is that it's too hard and it's 'easier' to just do the Prescriptive Path. So, this option is certainly not a loophole.

3. **"It would not apply to buildings with central heat and water...and questions of applicability."** It was mis-stated during CAH testimony on CE44 that this ERI Path is not permitted for buildings with central systems. That is incorrect. All building types/systems are permitted. ANSI 301-2019 has clear guidance that allows central systems to be modeled, and their shared energy pro-rated to the dwelling unit.

4. **"There are too many questions about equivalency, difference between HERS and ERI."** While there may be some confusion about HERS vs ERI, it's still a code-compliant path that is being offered in IECC-R. The approved software tools are not confused and it's as simple as printing out a report that says 2018 IECC ERI vs HERS. HERS and ERI will always have different numerical values as RESNET "HERS" will always use the most current version of ANSI 301, with amendments, whereas the IECC is stuck with the most recent copy available as of January 2019 (frozen at the 2019 edition, with no amendments). In all likelihood, by the time states adopt 2021 IECC, RESNET will have progressed to using ANSI 301-2022. As for equivalency and consistency across Raters calculating ERI on dwelling units, I have reviewed plenty of ASHRAE 90.1 Appendix G energy models and inconsistency across modeling software and energy modelers is NOT limited to the ERI Path! Modeling tools are only as good as what you enter and this inconsistency is a problem for the ASHRAE Path too. At least the ERI Path has some semblance of a QA plan and the software tools all automate the Reference Design (not the case with most 90.1 tools). There are no requirements (that I know of) in ASHRAE 90.1 or in C407 that requires the modeler to have any training or certification or continuous oversight of their work by a third-party.

5. **"There is no cost data, and other performance paths available."** As noted above, there was no need to compare to other Commercial performance paths since the point was to simply allow these mid and high rise to use the same Reference as permitted by code of low-rise MF. The cost data was mentioned at a high-level in the proposal - it would likely cost less to do the ERI Path as typically a group of models that reflect typical floor plans are eventually duplicated to create the other units in the building. It could cost more because imbedded in R406 are a handful of mandatory items, like air leakage test. It's difficult to determine the cost impact of something that is simply an option, not a requirement.

I urge your support of this code change proposal, as modified by this public comment, so that we can at a minimum, finally offer Multifamily a code compliance option that is the same for their low-rise multifamily buildings as it is for their mid and high-rise. This sets the precedence for future amendments to continue this work and address any remaining concerns.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an option, not a requirement. Those that feel like the option will increase their costs will not choose it.

Public Comment# 2021

Public Comment 2:

IECC@: C401.2

Proponents:

Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

Exception: Dwelling units and sleeping units in Group R-2 buildings without systems serving multiple units shall be deemed to be in compliance with this chapter provided they comply with Section R406.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Commenter's Reason: To avoid repeating my prior public comment reason statement, which rebutted the Committee reasons for disapproving CE44, this public comment provides a modification to the code change proposal that limits its applicability to dwelling and sleeping units that have their own individual systems. While this limitation is not necessary, it does seem to address some concerns raised by the Committee and opponents giving testimony, while still at least offering this option to dwelling units that are very similar in construction as those in low-rise MF and therefore well suited to the ERI Path.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Again, as this is an optional path, not a requirement, there is no increase or decrease to the cost of construction. If the costs increase for a certain building, the option would not be selected.

Public Comment# 2055

CE49-19

IECC@: C401.2, C407.3

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85.80 percent of the standard reference design building.

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to 80 percent of the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

Reason: The purpose of this code change proposal is to improve the efficiency of buildings designed to comply under the IECC performance path by altering the multiplier for the standard reference design building from 85% to 80%. Starting with the 2012 IECC, rather than undertake a complete retooling of the performance path, advocates added a percentage multiplier to the standard reference design to reduce the energy budget for the baseline. This approach provided maximum flexibility to the code user. Improvements could be made to any part of the building to achieve the 15% improvement. This approach also established a means of easily updating the performance path in the future: As additional efficiency is needed, the multiplier can be lowered to meet those needs.

Since the 2012 IECC, the 85% multiplier has not been changed, even though other parts of the commercial IECC have undergone improvements. This proposal updates the multiplier by essentially improving efficiency by about 5% (as compared to the original baseline code, the 2009 IECC).

This proposal also includes the same multiplier in Section C407.3. We believe this is a more appropriate place for the multiplier, since it is closer to the other assumptions included in the standard reference design. However, we would prefer to see it included in both C407.3 and C401.2 to make sure that code users understand the requirements of the performance path.

Cost Impact: The code change proposal will increase the cost of construction

Adding additional efficiency measures will increase construction cost. However, we expect that design professionals and builders will select the improvements that are the most cost-effective and the easiest to implement into specific designs.

CE49-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The claim the envelope is maxed out is false. There is no cost analysis. We need to know the relationship between compliance paths before making such changes. (Vote 8-7)

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: C401.2, C407.3

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than ~~80~~ 95 percent of the standard reference design building.

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to ~~80~~ 95 percent of the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

Commenter's Reason: As the IECC and ASHRAE 90.1 require more efficiency and more stringent controls, it makes it more difficult to use this path. This modification will ensure lower energy costs, with a more realistic reduction requirement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The original proposal further tightens the energy cost requirement for designing a proposed building using the performance path option. This results in an exponentially greater cost of construction (per square foot) because it generally costs exponentially more to achieve a very high level of energy efficient construction (the best windows, the best insulation, extremely tight construction, etc.). Such extremely high costs will eliminate the performance path as a viable, cost effective code compliance option. The baseline energy cost for the proposed design has already been lowered since the 2012 IECC by more stringent and reasonably achievable requirements for energy efficient construction in the standard reference design. These improvements haven't been properly accounted for in the proponent's percentage adjustments. This public comment adjusts the percentage higher than the current code to properly account for the cost effective and greater levels of efficiency of the 2018 (and 2021) standard reference design. In this way, the public comment negates the proponent's increase of cost of construction.

Public Comment# 1710

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it is a straightforward improvement in efficiency for commercial buildings designed using the performance path that will reduce energy costs for these buildings by roughly 5%. The 85% multiplier was originally incorporated into the performance path in the 2012 IECC as a means of improving efficiency while maintaining flexibility. Since the 2012 IECC, there have been quite a few changes to other parts of the code, but the 85% multiplier in the performance path has remained the same. CE49 is a sensible, easy-to-implement efficiency improvement for the performance path; it is reasonable to improve this figure now after 9 years of no change.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated in the original proposal, adding additional efficiency measures will increase construction cost. However, we expect that design professionals and builders will select the improvements that are the most cost-effective and the easiest to implement into specific designs.

Public Comment# 1448

CE53-19

IECC: C202(New), C401.2.2(New), C406.5

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

RENEWABLE ENERGY CERTIFICATE (REC). An instrument that represents the environmental attributes of one megawatt-hour of renewable electricity; also known as an energy attribute certificate (EAC).

Add new text as follows:

C401.2.2 On-site renewable energy Each building site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors. Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m²·day (1.1 kBtu/ft²·day).
2. Any building where more than 80 percent of the roof area is covered by any combination of equipment other than for on-site renewable energy systems, planters, vegetated space, skylights or occupied roof deck.
3. Any building where more than 50 percent of roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 AM and 4:00 PM.

Revise as follows:

C406.5 On-site renewable energy. The total minimum ratings of on-site renewable energy systems, not including on-site renewable energy system capacity used for compliance with Section C401.2.2, shall be one of the following:

1. Not less than 1.71 Btu/h per square foot (5.4 W/m²) or 0.50 watts per square foot (5.4 W/m²) of conditioned floor area.
2. Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Reason: Onsite renewable energy installations are becoming widespread in many parts of the country, and mandatory in other parts. This proposal creates a mandatory requirement for a system that is approximately one-half of the capacity that has been a compliance package selection in Section 406 since the 2012 IECC.

This language is largely based on Addendum "by" now pending to modify ASHRAE 90.1-2016. The three exceptions are written to ensure that the requirement is not being applied to buildings without adequate space on the roof, to buildings that are in areas of the country where unblocked insolation levels do not provide enough energy to make the equipment cost-effective (according to ASHRAE cost-effective criteria), and to buildings where solar access is wholly or partially blocked. The economic analysis supporting the Addendum is what was used to derive the specifications in the measure's exceptions. The analysis included multi-variate calculations on the PNNL 3-Story Medium Office Bldg Prototype and modeled @ 0.25W/SF of renewable capacity for conditioned area on all 3 floors. The solar equipment on the prototype models passed the ASHRAE Economic Scalar in 5 of 6 insolation zones. The sixth zone aligns with the third exception in the proposal.

Section 406.5 is modified so that the renewable capacity used for compliance with the new minimum requirement is not also counted towards compliance with Section 406.

The proposal also ensures that renewable energy used for compliance with another obligation (eg. through the transfer of RECs then applied to a state Renewable Portfolio Standard) is not double counted towards compliance with the IECC. While this proposal does not cite Green-E, the Green-E Standard describes how double counting occurs when RECs associated with an on-site system have been transferred to another party in the transaction for the onsite renewable system (such as a lease or financing contract) and are then counted towards code compliance:

Examples of prohibited double uses include, but are not limited to:

- 1) *When the same REC is sold by one party to more than one party, or any case where another party has a conflicting contract for the RECs or the*

renewable electricity;

2) When the same REC is claimed by more than one party, including any expressed or implied environmental claims made pursuant to electricity coming from a renewable energy resource, environmental labeling or disclosure requirements. This includes representing the energy from which RECs are derived as renewable in calculating another entity's product or portfolio resource mix for the purposes of marketing or disclosure;

3) When the same REC is used by an electricity provider or utility to meet an environmental mandate, such as an RPS, and is also used to satisfy customer sales under Green-e Energy; or

4) Use of one or more attributes of the renewable energy or REC by another party. This includes when a REC is simultaneously sold to represent "renewable electricity" to one party, and one or more Attributes associated with the same MWh of generation (such as CO2 reduction) are also sold, to another party.

Bibliography: Addendum by to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings; ASHRAE, January 2018. (pending at the time of submittal)
Green-e Renewable Energy Standard for Canada and the United States, Version 3.2; March 20, 2018.

Cost Impact: The code change proposal will increase the cost of construction
The representative average price for onsite renewable energy systems as analyzed in 2018 by the ASHRAE 90.1 working group was \$2.50 per installed watt of capacity, before incentives. The workgroup also indicated that the required capacity levels were cost-effective, according to ASHRAE criteria, for buildings in the areas that were subject to the requirement (i.e. not excepted from the requirement).

CE53-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: There are too many open ends on this, there is a chance to fix some of the problems identified in testimony such as including the modifications that did not get ruled in order Edwards 5, the other proposals referenced but not identified, and the REC issue. In addition reconsider item 2 there is concern that plans examiner would not read the it as intended. There are exceptions for high rise building need to be included, taking into such issues as recreational spaces, terracing, etc and the departments having ability to identify buildings for which not feasible (Vote: 13-2).

Assembly Action:

None

CE53-19

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION, (New), C401.2.2 (New), C407.3

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION G202 GENERAL DEFINITIONS

RENEWABLE ENERGY CERTIFICATE (REC): An instrument that represents the environmental attributes of one megawatt-hour of renewable electricity; also known as an energy attribute certificate (EAC).

C401.2.2 On-site renewable energy Each building site shall have ~~equipment for one or more~~ on-site renewable energy systems with a total rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors. ~~Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.~~

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m²-day (1.1 kBtu/ft²-day).
2. Any building where more than 80 percent of the roof area is covered by any combination ~~of equipment other than for on-site renewable energy systems~~, planters, vegetated space, skylights, walkways, or occupied roof deck area, mandatory access or set back as required by the International Fire Code, or equipment other than for on-site renewable energy systems.
3. Any building where more than 50 percent of roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 AM and 40 PM.
4. New construction or additions in which the sum of the conditioned floor area of the three largest floors of the construction or addition is less than 10,000 ft² (1,000 m²).
5. Alterations

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost and shall not include reduction in energy cost associated with on-site renewable energy system capacity used for compliance with Section C401.2.2. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

Commenter's Reason: Onsite renewable energy installations are becoming widespread in many parts of the country, and mandatory in other parts. This proposal creates a mandatory requirement for a system that is approximately one-half of the capacity that has been a compliance package selection in Section 406 since the 2012 IECC. This language is largely based on Addendum "by" now pending to modify ASHRAE 90.1-2016.

The proposed Public Comment addresses comments from the IECC Code Development Committee and opponents and brings the proposed change in line with Addendum BY for ASHRAE 90.1. The Public Comment also includes floor modifications that were developed to further bring CE53 in line with Addendum BY but that were ruled out of order at the Code Development Hearings.

This Public Comment does the following:

1. Strikes the definition and the requirement for Renewable Energy Credits.
2. Specifically calls out that buildings must have one or more on-site renewable systems instead of stating that the building must have equipment for on-site renewable systems. The term "system" is broader and implies that equipment be installed to generate energy and then transport that energy to the energy using features in the building.
3. Modified Exception 2 to better address high rise commercial construction and with the recognition that the roof area is limited in high rise construction. Language was reviewed for a similar provision from New York City. The proposed new language is consistent with ASHRAE Addendum BY.
4. Adds an exception for smaller commercial buildings (less than 10,000 ft²) for new construction and additions and also alternations.
5. Added language to C407.3 Performance-based compliance that only allows credit for renewables above what is required in C401.2.2.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The representative average price for onsite renewable energy systems as analyzed in 2018 by the ASHRAE 90.1 working group was \$2.50 per installed watt of capacity, before incentives. The workgroup also indicated that the required capacity levels were cost-effective, according to ASHRAE criteria, for buildings in the areas that were subject to the requirement (i.e. not excepted from the requirement).

CE54-19 Part II

IECC: R401.2, R401.2.1 (IRC N1101.13.1) (New), R401.2.1.1 (IRC N1101.13.1.1) (New), R401.2.1.2 (IRC N1101.13.1.2) (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Energy Conservation Code

R401.2 Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.
4. The tropical zone alternative in accordance with Section R401.2.1.

Revise as follows:

R401.2.1 (IRC N1101.13.1) Tropical zone. Residential buildings in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter ~~provided that where~~ the following conditions of either Section R401.2.1.1 or R401.2.1.2 are met

∴

1. ~~Not more than one-half of the occupied space is air conditioned.~~
2. ~~The occupied space is not heated.~~
3. ~~Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.~~
4. ~~Glazing in conditioned spaces has a solar heat gain coefficient of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.~~
5. ~~Permanently installed lighting is in accordance with Section R404.~~
6. ~~The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an R-value of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.~~
7. ~~Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.~~
8. ~~Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.~~
9. ~~Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.~~
10. ~~Interior doors to bedrooms are capable of being secured in the open position.~~
11. ~~A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.~~

R401.2.1.1 (IRC N1101.13.1.1) Limited air-conditioning option. Where a portion of the dwelling unit is provided with air-conditioning, all of the following shall be met:

1. Not more than one-half of the occupied space is air conditioned.
2. The occupied space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in conditioned spaces has a solar heat gain coefficient of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an R-value of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

Add new text as follows:

R401.2.1.2 (IRC N1101.13.1.2) Dwelling units without air-conditioning option. Where none of the occupied space of the dwelling unit is air-conditioned or heated, all of the following shall be met:

1. There are no requirements for glazing U-factor, SHGC or air tightness.
2. Permanently installed lighting is in accordance with Section R404.
3. The exterior roof and wall surfaces shall have an 0.85 initial and 0.70 aged reflectivity or have insulation with an R-value of R-5 or greater.
4. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

5. Operable fenestration provides ventilation in each room. There shall be at least one window per face of the dwelling unit.
6. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
7. Interior doors to bedrooms are capable of being secured in the open position.
8. Ceiling fans are provided for a bedroom and the largest space that is not used as a bedroom.

Reason: Very low income housing needs a path to both house people and fall under the code. Some of these units are being built "informally", with everyone knowing they are not even attempting compliance. It is better to give them a very low cost path to improving peoples housing. Housing which does not heat or cool is already saving considerable energy over the "mainland" style housing the code presumes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It is hard to judge the cost of having a code apply to housing that is not even attempting to comply with the code now. What is the cost of not having a building code?

Staff Analysis: Please note that due to the requirements of the cdpACCESS system, where a new subsection is created and is populated with existing text, the existing text must be shown as removed from the existing section and shown as new in the new section. The 11 items in the new section R401.2.1.1 are the 11 items in the current code. They are simply relocated.

CE54-19 Part II

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This change is supported as it applies to unconditioned buildings (Vote: 6-5).

Assembly Action: **None**

CE54-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because the provisions of proposed section R401.2.1.2 further roll back energy efficiency provisions for the tropical climate zone and are simply inappropriate for any energy code, let alone the national model energy code. This new and expanded loophole to efficiency requirements has the potential to leave occupants uncomfortable and will very likely lead to increased energy use as owners and occupants of these buildings add window air-conditioning units to improve comfort after-the-fact.

It is important to keep in mind the broad reach of the IECC's tropical climate zone. As currently defined in the IECC, the tropical climate zone covers all "islands in the area between the Tropic of Cancer and the Tropic of Capricorn." See Section R301.4. It is reasonable to expect that many homes in this region will require some amount of space cooling -- homes in the tropical zone (which overlaps with climate zone 1) can have up to 9,000 Cooling Degree Days. See Table R301.3(2).

It is hard to imagine why buildings in this climate zone would not be designed to maintain reasonable indoor temperatures, but proposed section R401.2.1.2 ("without air conditioning option") does exactly that: "1. There are no requirements for glazing U-factor, SHGC or air tightness." Having no window SHGC control, for example, means that the occupant is fully subjected to the discomfort of solar gain, particularly due to direct sunlight. Constructing dwelling units with little thermal or solar control and hoping that occupants actively operate windows, doors, and ceiling fans to manage indoor temperatures seems shortsighted, at best. Many of the occupants of these units will turn to window-mounted air conditioning units at some point, negating any projected "savings" from the "without air conditioning option." These units will use far more energy than buildings constructed to the minimum requirements of climate zone 1.

This proposal is a bad solution in search of a problem. The IECC already provides a compliance option for the tropical climate zone that is far less

efficient than climate zone 1. The reason provided for CE54 creates a strawman argument of “informal” housing in Puerto Rico – presumably non-code-compliant buildings – and argues that if the IECC had an even weaker set of requirements for the tropical climate zone, maybe builders in Puerto Rico could be convinced to follow the code. This argument could be made for any climate zone to justify reduced stringency, but it is simply not a valid justification for reducing the minimum code requirements. “Informal” housing probably also does not meet structural, fire, or electrical code requirements – but no party would reasonably argue that this justifies setting less-safe requirements for buildings in Puerto Rico as well. And although supporters of RE54 repeatedly referenced Puerto Rico, the tropical climate zone covers a broad swath of territory that includes Hawaii. The new loophole created by CE54 is far less stringent than Hawaii’s current energy code, and it could be a huge setback for Hawaii’s energy efficiency efforts.

In sum, CE54 creates an even larger loophole in the code for homes in the tropical climate zone, and it is not supported by any data supporting claims that it would not reduce efficiency. It is simply not appropriate for the IECC, and it should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1449

Public Comment 2:

Proponents:

Gil Rossmiller, representing Self (gilrossmiller@coloradocode.net)

requests Disapprove

Commenter's Reason:

The committee got this one wrong. As the committee reason for approval stated “This change is supported as it applies to unconditioned buildings” says it all.

The Energy Code is for the “the design and construction of buildings for the effective use and conservation of energy”. One of the requirements of the code change is that the building is not heated or cooled.

The proposal then sets several other design requirements, that are more of an overall design criterion that would normally be found in the IRC part III.

While I understand what the proponent is wanting to create. This does not belong in the energy code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1310

NOTE: CE54-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE54-19 Part I

IECC@: C401.2, C401.3 (New), C401.3.1.1 (New), C401.3.2 (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

The requirements of ANSI/ASHRAE/IESNA 90.1. 2.

The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Tropical zone alternative in C401.3

Add new text as follows:

C401.3 Tropical zone alternative. Group R-2 buildings in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter where the conditions of either Section C401.3.1 or C401.3.2 are met.

C401.3.1.1 Limited air-conditioning option. Where a portion of the dwelling unit is provided with air-conditioning, all the following shall be met:

1. Not more than one-half of the occupied space is air conditioned.
2. The occupied space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in conditioned spaces has a solar heat gain coefficient of less than or equal to 0.30, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an R-value of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

C401.3.2 Dwelling units without air-conditioning option. Where none of the occupied space is air conditioned or heated, all of the following shall be met:

1. There are no requirements for glazing U-factor, SHGC or air tightness.
2. Permanently installed lighting is in accordance with Section R404.
3. The exterior roof and wall surfaces have an 0.85 initial and 0.70 aged reflectivity or have insulation with an R-value of R-5 or greater.
4. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
5. Operable fenestration provides ventilation in each room. There shall be at least one window per face of the dwelling unit.
6. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
7. Interior doors to bedrooms are capable of being secured in the open position.
8. Ceiling fans are provided in at least one bedroom and in the largest space that is not used as a bedroom.

Reason: Very low income housing needs a path to both house people and fall under the code. Some of these units are being built "informally", with everyone knowing they are not even attempting compliance. It is better to give them a very low cost path to improving peoples housing. Housing

which does not heat or cool is already saving considerable energy over the "mainland" style housing the code presumes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

It is hard to judge the cost of having a code apply to housing that is not even attempting to comply with the code now. What is the cost of not having a building code?

CE54-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal would create uncomfortable and inefficient conditions, there are aftermarket concerns, and this is not the appropriate for medium and high rise residential construction (Vote: 14-1).

Assembly Action:

None

CE54-19 Part I

CE55-19

IECC C401.3(New)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Add new text as follows:

C401.3 Thermal envelope certificate (Mandatory). A permanent thermal envelope certificate shall be completed by an *approved party*. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other *approved location*. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include:

1. R-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*;
2. U-factors and *solar heat gain coefficients* (SHGC) of fenestration;
3. Results from any *building envelope air leakage testing* performed on the *building*

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10% or more of the total component area.

Reason: The purpose of this code change proposal is to add a permanent certificate to commercial buildings that will record basic information related to the building thermal envelope. This is similar to the requirement for residential buildings in Section R401.3, which has been in the IECC since at least the 2006 edition and has been successfully integrated into software programs such as REScheck. A significant percentage of commercial buildings will undergo system commissioning under Section C408, which will include documentation of mechanical and lighting systems. However, there is no similar requirement or documentation for the building's thermal envelope components. We acknowledge that the commercial provisions of the IECC are intended to cover an extremely broad range of commercial buildings, so the certificate requirement has been simplified to cover only the basic elements of the thermal envelope.

The information contained in this certificate will be readily available at construction, but as the building ages and ownership is transferred, some of this critical information could be lost. As future owners or lessors undertake load calculations for HVAC sizing or other measures that require a working knowledge of the building's thermal envelope characteristics, this information will be important. Recording the information in a permanent manner in an approved location at the building, as well as including documentation in the construction files for the project would not be overly burdensome but would provide valuable information to future building owners.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The information required to be included in the thermal envelope certificate will be readily available at construction and can be easily integrated into compliance software. This same information could be difficult to obtain several years down the road and recording it at construction will save future owners and lessors of a commercial building both time and money.

CE55-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This is a good direction to go, it gives future designers direction on the envelope when spaces change out occurs (Vote: 15-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE55-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests Disapprove

Commenter's Reason: Why must it be completed by a third party?

Located in room with "conditioning equipment", "utility room", and maybe "an electrical panel"? Is this a game of "Where's Waldo"? How many locations could this be in a large building?

If there are different values this specifies an "area weighted average". A replacement product is seldom going to be the average of all products in a building.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There could be some cost to gather the information. Presumably the required third party will want to be paid.

Public Comment# 2109

CE56-19

IECC@: 202, 202, 202 (New), C402.1.1, 402.1.1.1 (New), TABLE C402.1.1.1 (New)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

FENESTRATION. Products classified as either skylights or vertical fenestration.

Skylights Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal, including unit skylights, tubular daylighting devices and glazing materials in solariums, sunrooms, roofs, greenhouses, and sloped walls.

Vertical fenestration Windows that are fixed or operable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of not less than 60 degrees (1.05 rad) from horizontal.

Revise as follows:

GREENHOUSE. A structure or a thermally isolated area of a building that maintains a specialized sunlit environment exclusively used for, and essential to, the cultivation, protection or maintenance of plants. Greenhouses are those that are erected for a period of 180 days or more.

Add new definition as follows:

INTERNAL CURTAIN SYSTEM. An internal curtain system consists of moveable panels of fabric or plastic film used to cover and uncover the space enclosed in a greenhouse on a daily basis.

Revise as follows:

C402.1.1 Low-energy buildings and greenhouses. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft² (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. ~~Greenhouses.~~

Add new text as follows:

402.1.1.1 Greenhouses Greenhouse structures or areas that are mechanically heated or cooled and that comply with all of the following shall be exempt from the building envelope requirements of this code:

1. Exterior opaque envelope assemblies comply with Sections C402.2 and C402.4.5.

Exception: Low energy greenhouses that comply with Section C402.1.1.

2. Interior partition building thermal envelope assemblies that separate the greenhouse from conditioned space comply with Sections C402.2, C402.4.3 and C402.4.5.

3. Fenestration assemblies that comply with the thermal envelope requirements in Table C402.1.1.1. The U-factor for a roof shall be for the roof assembly or a roof that includes the assembly and an internal curtain system.

Exception: Unconditioned greenhouses.

TABLE C402.1.1.1
FENESTRATION THERMAL ENVELOPE MAXIMUM REQUIREMENTS

Component	U-factor (BTU/h-ft2-° F)
Skylight	0.5
Vertical fenestration	0.7

Reason: Greenhouses are currently exempt from the energy code through the low-energy building path even though they can use substantial amounts of energy. This proposal places commonplace envelope requirements on the structure when it is being mechanically heated or cooled. Low-energy use greenhouse structures are still exempt if they have a low energy usage per square foot in line with C402.1.1.

Cost Impact: The code change proposal will increase the cost of construction. Costs of \$1.27/sqft are based on a one-time installation cost of double IR poly-film at \$0.10/sqft and a thermal curtain at \$1.17/sqft. These costs are based on product offerings and utility rebate program findings. Total size of greenhouse assumed to be an average size single bay with dimensions of 35 feet wide, 100 feet long, 4-foot sidewalls and 14-foot total ceiling height.

CE56-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Encourage the proponent to bring it back in public comment with corrected formatting, issues include using italics in the definition, putting the 180 day requirement in the definition, the definition of internal curtain system, and there is some disconnected code language (Vote: 12-3).

Assembly Action:

None

CE56-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.1.1, 402.1.1.1 (New)

Proponents:

Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft² (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses that are not expected to operate more than 3 months per year and are not mechanically heated.

402.1.1.1 Greenhouses ~~Greenhouse structures or areas that are mechanically heated or cooled and that~~ comply with all of the following shall be exempt from the building envelope requirements of this code:

1. ~~All non-opaque *building thermal envelope* assemblies have an average U-factor less than or equal to 0.7 BTU/hr-ft²-°F. Exterior opaque envelope assemblies comply with Sections C402.2 and C402.4.5.~~

Exception: ~~Low energy *greenhouses* that comply with Section C402.1.1.~~

~~2. Interior partition *building thermal envelope* assemblies that separate the *greenhouse* from conditioned space comply with Sections C402.2, C402.4.3 and C402.4.5.~~

~~3. Fenestration assemblies that comply with the thermal envelope requirements in Table C402.1.1.1. The U-factor for a roof shall be for the roof assembly or a roof that includes the assembly and an *internal curtain system*.~~

Exception: ~~Unconditioned *greenhouses*.~~

Commenter's Reason: To address public comment, language has been substantially revised and clarified to remove duplicate information. The requirements set forth in this proposal would impact only greenhouses that use mechanical heating for a large part of the year. This proposal is not intended to impact small greenhouse facilities or part year operations.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The non-opaque assembly U-factor is based on readily available materials in the market. Costs of \$1.27/sqft were based on a one-time installation cost of double IR poly-film at \$0.10/sqft and a thermal curtain at \$1.17/sqft. These costs are based on product offerings and utility rebate program findings. Greenhouses can meet the minimum non-opaque thermal provisions specified in here without a thermal curtain and double-wall poly film, making payback less than 2 years. Total size of greenhouse assumed to be an average size single bay with dimensions of 35 feet wide, 100 feet long, 4-foot sidewalls and 14-foot total ceiling height.

Public Comment# 2156

Public Comment 2:

Proponents:

Matthew Stuppy, Stuppy, Inc., representing National Greenhouse Manufacturing Association (mjstuppy@stuppy.com)

requests Disapprove

Commenter's Reason: CE56 should remain disapproved. The proposal has many issues that require an extensive re-write rather than a public comment.

Some of the issues include:

1. Lumping greenhouses in with skylights and sunrooms. A greenhouse has a stand-alone function of growing and maintaining plants. A greenhouse is not an accessory to a building.
2. Removing greenhouses from C402.1.1 and moving it into the title of the section. This undoes the work in previous code revisions to acknowledge that greenhouses have a primary function of growing plants and that energy in a greenhouse is used for plant production, not simply conditioning space.
3. There are no considerations for crop type, seasonal production, and geographic location.
4. There is no consideration for the size of the greenhouse operation, which affects cost efficiencies and implementation of energy screens.

The benefits of a greenhouse included reduced water consumption, use of solar energy for growing plants, and the ability to efficiently produce fruits, vegetables and flowers year-round. Greenhouse businesses, like all manufacturing and production business require energy inputs. The primary energy input is the Sun and greenhouses require specialized glazing in order to maximize the Sun's benefits. Regulating greenhouses on their primary production function is analogous to regulating an automotive manufacturers assembly line, or a baking company's ovens.

Included for reference is a brochure published by the NGMA to promote energy savings. The NGMA welcomes working with other groups in the next code cycle to enhance energy saving techniques used for greenhouses.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No Change to code text.

The original proposal's cost impact analysis is understated.

The cost of double IR poly-film would be closer to \$0.20 for the materials. Those materials would need to be replaced every three to five years. Typical installation costs vary between 100% and 150% of the material costs. Additionally, an inflation fan is required to run twenty-four hours a day. Growers in colder climates have already adopted double poly as a standard practice. Under this proposal some growers who have seasonal production with a short heating period would be forced to adopt these glazing changes without a payback on their investment.

The cost of a retractable heat retention system is understated. Materials for the 35 ft x 100 ft long structure example would be closer to \$2.80 per square foot plus taxes and shipping costs. Labor would be an additional \$1.50 to \$3.20 per square foot. Besides the energy curtain, control systems would have to be installed or modified at an additional expense. There are also annual maintenance costs associated with the systems. While these systems do provide heat retention in the winter months, they would have limited to no payback for growers who do not grow year-round.

Public Comment# 1568

CE57-19

IECC C402.1.1

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft² (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses.
4. Buildings with a floor area not greater than 1,100 square feet (102.2 square meters) in size and solely used to house electric distribution system equipment.

Reason: These buildings are used to house electric distribution equipment, not people. They are equipment sheds or equipment vaults. Any space conditioning installed is only meant to prevent damage to equipment due to extreme weather or storms. The amount of time that people work in these buildings (for maintenance or testing or repair) is minimal.

Based on feedback from EEI member companies, anywhere from 50% to 100% of utility vaults or enclosed switching stations or substations are not conditioned at all. For electric equipment buildings that are conditioned, the temperature settings are typically much higher in the summer (85 degrees F or higher) and much lower in the winter (60 degrees F or lower) than spaces that are meant for human comfort to be maintained on a regular basis.

Some of the electric equipment vaults being used by utilities are as large as 18 feet by 60 feet, or 1,080 square feet. The size limit of 1,100 square feet will ensure that the exemption is limited to these types of buildings.

Bibliography: Specifications for vaults from from different utilities can be found at the following web site links:

<https://www.coned.com/-/media/files/coned/documents/es/specs/electricbluebook.pdf>

<https://www.smud.org/-/media/Documents/Business-Solutions-and-Rebates/PDFs/Customer-Built-Vaults.ashx?la=en&hash=ACE6D4512846A1FC65A8A37EEE224AC31C2791BF>

https://www.nationalgridus.com/media/pronet/constr_esb754759.pdf

Cost Impact: The code change proposal will decrease the cost of construction

This proposal is adding an exemption to the envelope requirements of Section Chapter 4, and as a result, will decrease the cost of construction for these low energy buildings.

CE57-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This opens a new unnecessary loophole without analysis (Vote: 15-0).

Assembly Action:

None

CE57-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.1.1 (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft² (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses.
4. Buildings owned by utilities with a floor area not greater than ~~4,100~~ 1,200 square feet (~~402.2~~ 110 square meters) in size and solely used to house electric or gas distribution system equipment.

Commenter's Reason: This language will be consistent with the language that was approved in CE-58. Also, in terms of energy usage in these buildings, they are located on the utility side of the meter, not on the customer side. So any energy consumed at these utility buildings will not be part of any baseline or proposed building design, since they are not part of the building energy consumption.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. These buildings are owned and constructed by utilities, even though they are located at the building site. The costs of construction for these buildings are taken care of by the utility, not the building owner.

Public Comment# 1289

Public Comment 2:

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason: These buildings are used to house electric distribution equipment, not people. They are equipment sheds or equipment vaults. Any space conditioning installed is only meant to prevent damage to equipment due to extreme weather or storms. The amount of time that people work in these buildings (for maintenance or testing or repair) is minimal. Based on feedback from EEI member companies, anywhere from 50% to 100% of utility vaults or enclosed switching stations or substations are not conditioned at all. For electric equipment buildings that are conditioned, the temperature settings are typically much higher in the summer (85 degrees F or higher) and much lower in the winter (60 degrees F or lower) than spaces that are meant for human comfort to be maintained on a regular basis.

Some of the electric equipment vaults being used by utilities are as large as 18 feet by 60 feet, or 1,080 square feet. The size limit of 1,100 square feet will ensure that the exemption is limited to these types of buildings.

Bibliography: Specifications for vaults from different utilities can be found at the following web site links:

<https://www.coned.com/-/media/files/coned/documents/es/specs/electricbluebook.pdf>

<https://www.smud.org/-/media/Documents/Business-Solutions-and-Rebates/PDFs/Custom-Built-Vaults.ashx?la=en&hash=ACE6D4512846A1FC65A8A37EEE224AC31C2791BF>

https://www.nationalgridus.com/media/pronet/constr_esb754759.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This proposal is adding an exemption to the envelope requirements of Section Chapter 4, and as a result, will decrease the cost of construction for

these low energy buildings.

Public Comment# 1580

CE61-19

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a,1}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Metal buildings ^b	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS <u>R-30</u> + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS <u>R-25</u> + R-11 LS	R-30 + R-11 LS <u>R-25</u> + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38 R-49	R-38 R-49	R-38 R-49	R-49	R-49	R-49	R-49 R-60	R-49 R-60	R-49 R-60	R-49 R-60

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Metal buildings	U- 0.044 U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.035	U- 0.031	U- 0.031 U- 0.029	U- 0.029	U- 0.029	U- 0.029 U- 0.026	U- 0.029 U- 0.026
Attic and other	U- 0.027	U- 0.027	U- 0.027	U- 0.027	U- 0.027	U- 0.027	U- 0.027 U- 0.021	U- 0.027 U- 0.021	U- 0.027 U- 0.021	U- 0.021	U- 0.021	U- 0.021	U- 0.021 U- 0.017	U- 0.021 U- 0.017	U- 0.021 U- 0.017	U- 0.021 U- 0.017

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for roofs. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction

The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE61-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: When we have cost effectiveness analysis for more efficient features we need to go with them (Vote: 14-1).

Assembly Action:

None

CE61-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proponents:

Jonathan Humble, FAIA, NCARB, LEED AP-BD+C, representing American Iron and Steel Institute and the Metal Building Manufacturers Association (jhumble@steel.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Metal buildings ^b	R-19 + R-11 LS R- 10+R- 19FC	R-19 + R-11 LS R- 10+R- 19FC	R-19 + R-11 LS R- 10+R- 19FC	R-19 + R-11 LS R- 10+R- 19FC	R-19 + R-11 LS LS R- 10+R- 19FC	R-19 + R-11 LS R- 10+R- 19FC	R-19 + R-11 LS or R- 25+R- 8LS	R-25 + R- 11 LS	R-30 + R-11 LS	R-30 + R- 11 LS	R-30 + R-11 LS	R-25 + R- 11 + R-11 LS	R-25 + R-11 + R-11 LS			
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System, FC = Filled Cavity with insulation perpendicular to purlins.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.035 U-0.041	U-0.035 U-0.41	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.037	U-0.035 U-0.037	U-0.035 U-0.037	U-0.035 U-0.037	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass ^g	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.064	U-0.045
Wood framed and other ^c	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, below grade																
Below-grade wall ^c	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-1.140 ^e	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass ^d	U-0.322 ^e	U-0.322 ^e	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066 ^e	U-0.066 ^e	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-grade floors																
Unheated slabs	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.73 ^e	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs ^f	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55
Opaque doors																
Swinging door	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly U-factors, C-factors, and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

- b. Where U -factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R -value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the U -factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These C -, F - and U -factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposed modification brings the remaining U-factors and R-values from ASHRAE Standard 90.1 which that were not included in the original code change proposal.

The reason for this public comment is based on the testimony of the proponents and supporters of the original code change proposal which used the ASHRAE Standard 90.1 methodology as a basis for substantiation. Their statement was that the proposal leveraged "...ASHRAE's thorough energy savings and cost-effectiveness analysis..." to support the need to bring over the values.

Since that Standard 90.1 methodology they describe applies the all the R-values and U-factors contained in Standard 90.1 opaque envelope tables it appropriate then to bring over "all" the values since they "all" represent energy efficient and cost effective opaque envelope requirements.

A footnote was also added to address the new acronym "FC".

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The public comment is in line with the original proposal which has updated the opaque envelope requirements and therefore because of those modifications will increase the cost of construction.

Public Comment# 1970

Public Comment 2:

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Metal buildings ^b	R-19 +	R-19 +	R-19 +	R-19 +	R-19 +	R-19 +	R-19 +	R-19 +	R-19 +	R-19 +	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS
	R-11	R-11	R-11	R-11	R-11	R-11	R-11	R-11	R-11	R-11						
	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS						
	R-10 +	R-10 +	R-10 +	R-10 +	R-10 +	R-10 +	or R-	or R-	or R-	or R-						
R-19	R-19	R-19	R-19	R-19	R-19	25 + R-	25 + R-	25 + R-	25 + R-	8 LS	8 LS	8 LS	8 LS			
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R								
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.041	U-0.035 U-0.037	U-0.035 U-0.037	U-0.035 U-0.037	U-0.035 U-0.037	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass ^g	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077 U-0.124	U-0.077 U-0.124	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.064	U-0.045						
Wood framed and other ^c	U-0.064 U-0.089	U-0.064 U-0.089	U-0.064 U-0.089	U-0.064 U-0.089	U-0.064 U-0.089	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, below grade																
Below-grade wall ^c	C-1.140 ^e	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092					
Floors																
Mass ^d	U-0.322 ^e	U-0.322 ^e	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066 ^e	U-0.066 ^e	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033							
Slab-on-grade floors																
Unheated slabs	F-0.73 ^e	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40					
Heated slabs ^f	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55
Opaque doors																
Swinging door	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37							
Garage door <14% glazing	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31									

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposal as submitted cherry picked and only included changes from ASHRAE 90.1-16 that improved energy efficiency without taking into consideration the the changes in ASHRAE 90.1-16 that where also considered cost effective but somewhat lowered energy efficiency. In doing so the proposal as approved does not make IECC cost effective. The changes in ASRHAE 90.1-16 did in some cases lower insulation levels from previous editions of ASHRAE 90.1-16 based updated cost data that determined some requirements in previous editions of ASHRAE 90.1-16 were indeed not cost effective. Approval of this public comment will align IECC with the current requirements in ASHRAE 90.1 which are considered cost effective.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The proposal reduces the cost of construction by aligning the values with ASHRAE 90.1 that are less the the current values in the IECC and considered by ASHRAE to be the maximum based on the ASHRAE cost effective analysis.

Public Comment# 1162

Public Comment 3:

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19. We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent than the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents "a positive life cycle savings for the life of the building", even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the "best value", however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

CE63-19

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a,1}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R						
Walls, above grade																
Mass ^g	R-5.7ci ^c	R-5.7ci ^c	R-5.7ci ^c	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building								R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci		R-13 + R-13ci	R-13 + R-13ci
	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-17ci	R-13 + R-19.5ci	R-13 + R-19.5ci
Metal framed									R-13 + R-7.5ci		R-13 + R-7.5ci	R-13 + R-17.5ci				
	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-10ci	R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-15.6ci	R-13 + R-18.8ci	R-13 + R-18.8ci
Wood framed and other									R-13 + R-3.8ci or R-20							R-13 + R-15.6ci or R-20 + R-10ci
	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-18.8ci													

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- "Mass floors" shall be in accordance with Section C402.2.3.

- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass ^a	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.064	U-0.064
															<u>U-0.037</u>	<u>U-0.037</u>
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
								<u>U-0.050</u>	<u>U-0.050</u>	<u>U-0.050</u>	<u>U-0.050</u>	<u>U-0.050</u>	<u>U-0.050</u>	<u>U-0.044</u>	<u>U-0.039</u>	
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.064	U-0.045
									<u>U-0.055</u>	<u>U-0.055</u>	<u>U-0.049</u>	<u>U-0.049</u>	<u>U-0.049</u>	<u>U-0.042</u>	<u>U-0.037</u>	<u>U-0.037</u>
Wood framed and other ^c	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
									<u>U-0.051</u>	<u>U-0.051</u>					<u>U-0.032</u>	<u>U-0.032</u>

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
- Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- "Mass floors" shall be in accordance with Section C402.2.3.
- These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- The first value is for perimeter insulation and the second value is for full slab insulation.

g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from either ASHRAE Standard 90.1-2016 or the IECC for above-grade walls. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where we discovered clear errors or inconsistencies between the U-factor and R-value table, we corrected them.
- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction

The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE63-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: These are cost effective values that have gone through rigorous review (Vote: 13-2).

Assembly Action:

None

CE63-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proponents:

Jonathan Humble, FAIA, NCARB, LEED AP-BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute and the Metal Building Manufacturers Association (Jhumble@steel.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8		
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	
Walls, above grade																	
Mass ^g	R-5.7ci ^c	R-5.7ci ^c	R-5.7ci ^c	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ei R-0+R- 9.8ci	R-13+ R-6.5ei R-0+R- 9.8ci	R-13+ R-6.5ei R-0+R- 9.8ci	R-13+ R-13ei R-0+R- 9.8ci	R-13+ R-6.5ei R-0+R- 9.8ci	R-13+ R-13ei R-0+R- 13ci	R-13+ R-13ei R-0+R- 15.8ci	R-13+ R-14ei R-0+R- 19ci	R-13+ R-14ei R-0+R- 19ci	R-13+ R-14ei R-0+R- 19ci	R-13+ R-14ei R-0+R- 19ci	R-13+ R-14ei R-0+R- 19ci	R-13+ R-17ei R-0+R- 22.1ci	R-13+ R-19.5ei R-0+R- 22.1ci	R-13+ R-19.5ei R-0+R- 22.1ci	R-13+ R-19.5ei R-0+R- 25ci	R-13+ R-19.5ei R-0+R- 25ci
Metal framed	R-13+ R-5ei	R-13+ R-5ei	R-13+ R-5ei R-13+R- 3.8ci	R-13+ R-7.5ei R-13+R- 7.5ci	R-13+ R-7.5ei R-13+R- 5ci	R-13+ R-7.5ei R-13+R- 13+7.5ci	R-13+R- 17.5ci	R-13+ R-7.5ci	R-13+ R-10ci	R-13+ R-10ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-15.6ci	R-13+ R-18.8ci	R-13+ R-18.8ci	
Wood framed and other	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-7.5ci or R-20 + R-3.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci						

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass ^g	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.037	U-0.037
Metal building	U-0.079 U-0.094	U-0.079 U-0.094	U-0.079 U-0.094	U-0.079 U-0.094	U-0.079 U-0.094	U-0.052 U-0.072	U-0.052 U-0.060	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	U-0.039 U-0.044	U-0.039	U-0.039
Metal framed	U-0.077 U-0.124	U-0.077 U-0.124	U-0.077 U-0.084	U-0.064	U-0.064 U-0.077	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other ^c	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032						

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposed modification brings the remaining U-factors and R-values from ASHRAE Standard 90.1 which that were not included in the original code change proposal.

The reason for this public comment is based on the testimony of the proponents and supporters of the original code change proposal which used the ASHRAE Standard 90.1 methodology as a basis for substantiation. Their statement was that the proposal leveraged "...ASHRAE's thorough energy savings and cost-effectiveness analysis..." to support the need to bring over the values.

Since that Standard 90.1 methodology they describe applies the all the R-values and U-factors contained in Standard 90.1 opaque envelope tables it appropriate then to bring over "all" the values since they "all" represent energy efficient and cost effective opaque envelope requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The public comment is in line with the original proposal which has updated the opaque envelope requirements and therefore because of those modifications will increase the cost of construction.

Public Comment 2:

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass ^g	R-5.7ci ^e NR	R-5.7ci ^c	R-5.7ci ^c	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci R-19ci	R-25ci R-19ci
Metal building	R-13+ R-6.5ci <u>R-0+ 9.8ci</u>	R-13+ R-6.5ci <u>R-0+ 9.8ci</u>	R-13+ R-6.5ci <u>R-0+ 9.8ci</u>	R-13+ R-6.5ci <u>R-0+ 9.8ci</u>	R-13+ R-6.5ci <u>R-0+ 9.8ci</u>	R-13+ R-13ci <u>R-0+ R-13ci</u>	R-13+ R-13ci <u>R-0+ R-15.8ci</u>	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-17ci	R-13+ R-19.5ci <u>R-13+17ci</u>	R-13+ R-19.5ci	R-13+ R-19.5ci
Metal framed	R-13+ R-5ci	R-13+ R-5ci	R-13+ R-5ci <u>R-13+ R-3.8ci</u>	R-13+ R-7.5ci	R-13+ R-7.5ci <u>R-13+ R-5ci</u>	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-10ci	R-13+ R-10ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-15.6ci	R-13+ R-18.8ci	R-13+ R-18.8ci
Wood framed and other	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13+ R-7.5ci or R-20 + R-3.8ci or R-19+ R-5ci	R-13+ R-18.8ci	R-13+ R-18.8ci				

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-² °F.
- Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- "Mass floors" shall be in accordance with Section C402.2.3.
- Steel floor joist systems shall be insulated to R-38.
- "Mass walls" shall be in accordance with Section C402.2.2.
- The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- Not applicable to garage doors. See Table C402.1.4.

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass ^g	U-0.151 <u>U-0.580</u>	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.097 <u>U-0.048</u>	U-0.037 <u>U-0.048</u>
Metal building	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.052 <u>U-0.072</u>	U-0.052 <u>U-0.080</u>	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	U-0.039 <u>U-0.044</u>	U-0.039	U-0.039
Metal framed	U-0.077 <u>U-0.124</u>	U-0.077 <u>U-0.124</u>	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other ^c	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposal as submitted cherry picked and only included changes from ASHRAE 90.1-16 that improved energy efficiency without taking into consideration the changes in ASHRAE 90.1-16 that were also considered cost effective but somewhat lowered energy efficiency. In doing so the proposed as approved does not make IECC cost effective. The changes in ASHRAE 90.1-16 did in some cases lower insulation levels from previous editions of ASHRAE 90.1 based on updated cost data that determined some requirements in previous editions of ASHRAE 90.1 were indeed not cost effective. Approval of this public comment will align IECC with the current requirements in ASHRAE 90.1 which are considered cost effective.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. Minor changes in the insulation levels decrease the cost of construction but in doing so make the IECC cost effective.

Public Comment 3:

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org); Margo Thompson, representing National Multifamily Housing Council (mthompson@newportventures.net); Andrew Klein, representing Building Owners and Managers Association, International (andrew@asklein.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8		
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	
Walls, above grade																	
Mass ^g	R-5.7ei ^e NR	R-5.7ci ^c	R-5.7ci ^c	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ei R-19ci	R-25ei R-19ci	
Metal building	R-13+ R-6.5ei R-0+ 9.8ci	R-13+ R-6.5ei R-0+ 9.8ci	R-13+ R-6.5ei R-0+ 9.8ci	R-13+ R-13ei R-0+ 9.8ci	R-13+ R-6.5ei R-0+ 9.8ci	R-13+ R-13ei R-0+ 13ci	R-13+ R-13ei R-0+ 15.8ci	R-13+ R-13ei	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-14ci	R-13+ R-17ci	R-13+ R-19.5ei R-13+ 17ci	R-13+ R-19.5ci	R-13+ R-19.5ci
Metal framed	R-13+ R-5ei	R-13+ R-5ei	R-13+ R-5ei R-13 + R- 3.8ci	R-13+ R-7.5ci	R-13+ R-7.5ei R-13 + R- 5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-10ci	R-13+ R-10ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-15.6ci	R-13+ R-18.8ci	R-13+ R-18.8ci	
Wood framed and other	R-13+ R-3.8ei or R-20	R-13+ R-3.8ei or R-20	R-13+ R-3.8ei or R-20	R-13+ R-3.8ei or R-20	R-13+ R-3.8ei or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-3.8ci or R-20	R-13+ R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13+ R-18.8ci	R-13+ R-18.8ci						

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-^oF.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass ^g	U-0.151 <u>U-0.580</u>	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.097 <u>U-0.048</u>	U-0.097 <u>U-0.048</u>
Metal building	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.079 <u>U-0.094</u>	U-0.052 <u>U-0.072</u>	U-0.052 <u>U-0.080</u>	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	U-0.039 <u>U-0.044</u>	U-0.039	U-0.039
Metal framed	U-0.077 <u>U-0.124</u>	U-0.077 <u>U-0.124</u>	U-0.077 <u>U-0.064</u>	U-0.064	U-0.064 <u>U-0.077</u>	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other ^c	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064 <u>U-0.089</u>	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposal as submitted cherry picked the most stringent efficiency values from ASHRAE Standard 90.1-16 without taking into consideration the other values in the ASHRAE 90.1 tables which correlated all the values to make a cost-effective energy code according to ASHRAE cost effective methodology. When only picking the most stringent values, the code process is undermined as well as all the work that went into creating cost effective solutions to the building thermal envelope. The code change as approved does not make IECC cost effective. Approval of this public comment will align IECC with the current requirements in ASHRAE 90.1 for the whole table which is considered cost effective. Disapproving this public comment and approving the proposal as submitted only takes the most stringent values in 90.1 and makes the IECC not cost effective.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The public comment coupled with the proposal will not effective the cost of construction. The proposal as written will increase the cost of construction because the proponents are taking the most stringent values from ASHRAE 90.1 and plugging them into the table. This would align all

Public Comment 4:

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19. We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent than the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment 5:

Proponents:

Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests Disapprove

Commenter's Reason: CE63 cherry-picks values from ASHRAE 90.1 to require more insulation for some above-grade wall assemblies without providing any justification other than ‘ASHRAE did it first.’ This is problematic because:

- It makes the code less material neutral between framing systems in some climate zones; i.e. CZ 5 where current U-factors for metal and wood framed walls are identical but the change proposes different values for each material in that CZ. This violates the principle of the code (as stated in the preface) that the provisions should “*not give preferential treatment to particular types or classes of materials, products or methods of construction.*”
- It eliminates the prescriptive cavity only option for wood framed walls in CZ 5, replicating a problem the code currently has in CZ 6 and CZ 7 where state and local jurisdictions amend away the requirement for continuous insulation, leaving a prescriptive cavity requirement that is less stringent than readily available materials would dictate.
- It doesn't provide the cost-effectiveness calculation for ICC member voting representatives to evaluate when considering whether the

proposed change is merited. It does not identify how much energy is being saved and at what cost.

In the last cycle these proponents attempted a similar change (CE54-16). The hearing committee disapproved that proposal, giving this reason: *“A more specific cost effectiveness analysis is needed to justify the new numbers rather than a general analysis on 90.1 as a whole. The proposal imitates ASHRAE 90.1 where it is more stringent but does not imitate 90.1 where it is less stringent. The proposal does not align the IECC with 90.1. The proposal does not indicate how much energy is saved. Cost validation is needed.”* (<http://media.iccsafe.org/codes/2015-2017/GroupB/CAH/2016-Report-CAH.pdf>)

Just as with the current proposal, in PC2 to CE54-16 the proponents still did not provide the specific cost effectiveness analysis requested by the committee. This likely contributed to the 75% majority that voted to reject the proposal (<https://www.iccsafe.org/wp-content/uploads/2016-GroupB-Final-Action-Results-OGCV.pdf>)

Finally, the proponent notes that the envelope provisions of the IECC haven't advanced significantly since 2012. That is likely attributable to two factors: 1) Continued failure to document the cost effectiveness of proposed values. 2) The code is already at the point of diminishing returns with regard to the walls of opaque envelope; meaning the money is better spent on other energy improvements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1845

CE64-19

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a,1}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, below grade																
Below-grade wall ^d	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-12.5ci	R-12.5ci
							R-10ci	R-10ci	R-10ci	R-10ci	R-10ci	R-10ci	R-15ci	R-15ci	R-15ci	R-15ci

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, below grade																
Below-grade wall ^c	C- 1.140 ^e	C- 0.119	C- 0.119	C- 0.119	C- 0.119	C- 0.119	C- 0.119	C- 0.092	C- 0.092	C- 0.092	C- 0.092					
								<u>C-</u> 0.092		<u>C-</u> 0.092	<u>C-</u> 0.092	<u>C-</u> 0.063	<u>C-</u> 0.063	<u>C-</u> 0.063	<u>C-</u> 0.063	<u>C-</u> 0.063

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for below-grade walls. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction

The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE64-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: These are cost effective values that have gone through rigorous review. They have not been updated in several cycles (Vote: 14-1).

Assembly Action:

None

CE64-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter’s Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.

We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent than the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1910

CE65-19

IECC: TABLE C402.1.3

Proposed Change as Submitted

Proponents: Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing BCAP-IBTS (mguttpgh@aol.com)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a,1}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass ^e	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci	
Joist/framing	NR R-13	NR R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30 ^f				

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass ^d	U-0.322 ^e	U-0.322 ^e	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066 ^e	U-0.066 ^e	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to improve consistency by applying an R-value for joist/framing floors in climate zone 1 in Table C402.1.3 that matches the corresponding U-factor in Table C402.1.4. The U-factor for joist/framing floors in Table C402.1.4 is consistent with a wood-framed floor insulated to R-13, despite the "NR" notation and footnote "e," which indicate no insulation in the assembly. Because other U-factors and R-values for joist/framing floors in Table C402.1.3 are based on wood-framed assemblies, we applied the equivalent R-value requirement for a U-factor of 0.066, which is R-13. This will improve energy efficiency as compared to the current Table C402.1.3, but it will bring consistency to the two prescriptive tables and simplify enforcement.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. We believe the R-value equivalent in Table C402.1.4 is an error in the IECC and should be made consistent with the U-factor Table.

CE65-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: This corrects an error in the R-value table (Vote: 14-1).

Assembly Action:

None

CE65-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: The change as approved increases the insulation levels above the requirements in ASHRAE 90.1-16 without any cost justification and thus is not considered to be cost effective as determined by ASHRAE. See Public Comment to CE66-19 which was also approved making the same change. Public Comment to CE66-19 corrects the values to match ASHRAE 90.1-66 which is considered by ASHRAE procedures to be cost effective.

Public Comment# 1173

CE66-19

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a,1}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass ^e	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
							R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci	R-23ci	R-23ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30 ^f				
	R-13	R-13										R-38	R-38	R-38	R-38	R-38

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass ^d	U-0.322 ^e	U-0.322 ^e	U-0.107	U-0.087	<u>U-0.076</u>	<u>U-0.076</u>	<u>U-0.076</u>	<u>U-0.074</u>	<u>U-0.074</u>	<u>U-0.064</u>	<u>U-0.064</u>	<u>U-0.064</u>	<u>U-0.055</u>	<u>U-0.051</u>	<u>U-0.055</u>	<u>U-0.051</u>
					<u>U-0.074</u>	<u>U-0.074</u>	<u>U-0.057</u>	<u>U-0.051</u>	<u>U-0.057</u>	<u>U-0.051</u>	<u>U-0.051</u>	<u>U-0.051</u>	<u>U-0.042</u>	<u>U-0.042</u>	<u>U-0.038</u>	<u>U-0.038</u>
Joist/framing	U-0.066 ^e	U-0.066	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	<u>U-0.033</u>	<u>U-0.033</u>	<u>U-0.033</u>	<u>U-0.033</u>	<u>U-0.033</u>	<u>U-0.033</u>
											<u>U-0.027</u>	<u>U-0.027</u>	<u>U-0.027</u>	<u>U-0.027</u>	<u>U-0.027</u>	<u>U-0.027</u>

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
- Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- "Mass floors" shall be in accordance with Section C402.2.3.
- These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- The first value is for perimeter insulation and the second value is for full slab insulation.
- "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for floors. Because all framed floor systems will be required to be insulated to R-38, there is no longer a need for footnote “f” in Table C402.1.3. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where we discovered clear errors or inconsistencies between the U-factor and R-value table, we corrected them.
- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction

The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE66-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: Based on the reason statement, it makes corrections, and improves the R-values (Vote: 12-3).

Assembly Action:

None

CE66-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,i}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass ^e	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci	R-23ci	R-23ci
Joist/framing	R-13 NR	R-13 NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass ^d	U-0.322 ^e	U-0.322 ^e	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051	U-0.042	U-0.042	U-0.038	U-0.038
Joist/framing	U-0.066 U-0.282	U-0.066 U-0.282	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: This proposal increase the insulation levels above what is required in ASHRAE 90.1-16 and does not proved any cost justification for the change. The proposed modification returns the values for joist/frame to what is in the current version of ASHRAE 90.1-16 which by ASHRAE requirements is considered cost effective.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction The proposal reduces the insulation requirements to which are considered cost effective.

Public Comment# 1172

Public Comment 2:

Proponents:

Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19. We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1726

CE68-19

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a,1}**

Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	NR R-10 for 24" below	R-10 for 24" below R-15 for 24" below	R-10 for 24" below R-15 for 24" below	R-10 for 24" below R-15 for 24" below	R-10 for 24" below R-20 for 24" below	R-10 for 24" below R-20 for 24" below	R-15 for 24" below R-20 for 48" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below
Heated slabs ^h	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. "Mass walls" shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

Slab-on-grade floors																
Unheated slabs	F- 0.73 ^e	F- 0.54	F- 0.54	F- 0.54	F- 0.54	F- 0.54	F- 0.52	F- 0.40	F- 0.40	F- 0.40	F- 0.40					
							F- 0.54	F- 0.52	F- 0.52	F- 0.52	F- 0.51	F- 0.51	F- 0.434			
Heated slabs ^f	F- 1.02	F- 1.02	F- 1.02	F- 1.02	F- 0.90	F- 0.90	F- 0.86	F- 0.86	F- 0.79	F- 0.79	F- 0.79	F- 0.69	F- 0.69	F- 0.69	F- 0.69	F- 0.69
	0.74	0.74	0.74	0.74	0.74	0.74	0.64	0.64	0.64	0.64	0.55	0.55	0.55	0.55	0.55	0.55

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for slab-on-grade floors in climate zones 3-6. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction

The improved F-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE68-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: The proposal brings forward cost effective updates for unheated slabs (Vote: 13-2).

Assembly Action:

None

CE68-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter’s Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.

We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1727

CE69-19

IECC@: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-
VALUE METHOD^{a, i}**

Slab-on-grade floors															
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below				
Heated slabs ^h	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
- b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
- c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft² °F.
- d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- e. "Mass floors" shall be in accordance with Section C402.2.3.
- f. Steel floor joist systems shall be insulated to R-38.
- g. "Mass walls" shall be in accordance with Section C402.2.2.
- h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

Slab-on-grade floors																
Unheated slabs	F-0.73 ^c	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40					
													F-0.51	F-0.434	F-0.434	F-0.424
Heated slabs ^d	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- "Mass floors" shall be in accordance with Section C402.2.3.
- These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- The first value is for perimeter insulation and the second value is for full slab insulation.
- "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce building energy costs and improve long-term energy efficiency by adopting ASHRAE's more efficient and cost-effective requirements for unheated slab insulation in climate zones 7-8. The current IECC F-factors for unheated slabs in these climate zones do not correspond with the R-value requirements in Table C402.1.3, nor do they correspond with F-factor data for common slab-on-grade floor assemblies per Normative Appendix A of ASHRAE Standard 90.1-2016. We believe the F-factors in the IECC are in error, and we propose adopting both ASHRAE's R-values and F-factors for these climate zones. The result will be improved efficiency and consistency across the IECC's prescriptive tables. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."

Cost Impact: The code change proposal will increase the cost of construction

The improved F-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC's performance-based compliance paths. However, each component value selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product. This proposal will also correct an error in the IECC Table C402.1.4 and bring consistency between the two prescriptive tables, simplifying compliance and enforcement.

CE69-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: These are cost effective updates (11-4).

Assembly Action:

None

CE69-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19. We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent than the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents "a positive life cycle savings for the life of the building", even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the "best value", however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1730

CE73-19

IECC@: TABLE C402.1.4

Proposed Change as Submitted

Proponents: Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing BCAP-IBTS (mguttph@aol.com)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.044 U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to correct the U-factor for roof insulation for All Other metal buildings in climate zone 1. Even though the R-values in Table C402.1.3 for both Group R and All Other metal buildings in climate zone 1 are R-19+R 11 LS, the U-factor table applies a higher U-factor for All Other metal buildings. This proposal adopts the U-factor from Group R for both building types in climate zone 1, since it is closest to the R-19+R-11 LS U-factor equivalent in Table A2.3.3 in ASHRAE Standard 90.1 Normative Appendix A. The building envelope typically remains the same for many years after construction and it is particularly important to “get it right” at the time of construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The current metal building roof U-factor for All Other buildings is an error and is inconsistent with the R-value equivalent in Table C402.1.3.

CE73-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: There was no reason for U-factor to be different than R-value, this aligned them (Vote: 13-2).

Assembly Action:

None

CE73-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE C402.1.4

Proponents:

Jonathan Humble, FAIA, NCARB, LEED AP-BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute and the Metal Building Manufacturers Association (Jhumble@steel.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8		
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	
Roofs																	
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.035 U-0.041	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: We are recommending this code change have a further modification.

If successful with the AISI/MBMA public comment on CE61-19, this proposal intends to align the U-factor value with the CE61-19 public comment. The basis for the CE61-19 public comment reads: "The proposed modification brings the remaining U-factors and R-values from ASHRAE Standard 90.1 which that were not included in the original code change proposal. The reason for this public comment is based on the testimony of the proponents and supporters of the original code change proposal which used the ASHRAE Standard 90.1 methodology as a basis for substantiation. Their statement was that the proposal leveraged "...ASHRAE's thorough energy savings and cost-effectiveness analysis..." to support the need to bring over the values. Since that Standard 90.1 methodology they describe applies the all the R-values and U-factors contained in Standard 90.1 opaque envelope tables it appropriate then to bring over "all" the values since they "all" represent energy efficient and cost effective opaque envelope requirements."

In light of the fact that both CE61-19 and CE73-19 use ASHRAE Standard 90.1 as a basis for change, we are further reinforcing this goal by recommending that all U-factors contained in the Standard 90.1 climate zone opaque envelope table be brought over in total.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment may or may not increase the cost of construction depending if the building design complies through efficient envelope design or through adding more insulation.

CE75-19

IECC@: TABLE C402.1.4

Proposed Change as Submitted

Proponents: Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing BCAP-IBTS (mguttph@aol.com)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

**TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR
METHOD^{a, b}**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass ^d	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052 U-0.042	U-0.064	U-0.045
Wood framed and other ^c	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064 U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
- b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
- f. The first value is for perimeter insulation and the second value is for full slab insulation.
- g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to correct two errors in the U-factor for wall insulation in climate zones 5 and 7. In both cases, the U-factor does not match the corresponding R-value of the IECC. The proposal above not only brings the U-factor into alignment with the IECC R-value, but also brings it into alignment with the applicable U-factors and R-values in ASHRAE Standard 90.1-2016.

In climate zone 7, Group R metal-framed walls are required to be insulated to R-13+R-15.6 c.i. in both the IECC and ASHRAE Standard 90.1. ASHRAE Standard 90.1 includes an equivalent U-factor of 0.042, which corresponds with the R-value according to Standard 90.1 Normative Appendix A. However, the 2018 IECC includes an equivalent U-factor of 0.052, which is inconsistent. We believe the IECC U-factor is an error and should be changed to 0.042.

In climate zone 5, Group R wood-framed walls are required to be insulated to R-13+R-7.5 c.i., or R-20+R-3.8 c.i., but the U-factor equivalent clearly does not match up. ASHRAE Standard 90.1 specifies a U-factor of 0.051, which not only corresponds with the R-value, but also corresponds with the U-factor requirements in climate zones 6 and 7 (which also require R-13+5 + R-7.5 c.i., or R-20+R-3.8 c.i.). Here again, we believe the IECC U-factor is an error, and should be changed to 0.051.

The building envelope typically remains the same for many years after construction and it is particularly important to “get it right” at the time of construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The current U-factor equivalents for metal-framed walls in climate zone 7 and wood-framed walls in climate zone 5 are errors and are inconsistent with the R-value equivalent in Table C402.1.3.

CE75-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: There was no reason for U-factor to be different than R-value this aligned them. This is consistent with CE63 which will address any discrepancies (Vote: 13-2).

Assembly Action:

None

CE75-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This code change proposal does not correct any errors. The values have been in the IECC since 2009 and 2012 respectively with plenty of opportunity to address this claim during that time. In addition the proponents did not stipulate which code change proposal created the errors, so how are we to know?

The proposal merely copies values from ASHRAE Standard 90.1 with the reason statement giving the impression that copying ASHRAE Standard 90.1 is a standard operating procedure for IECC updates to these tables. This is not the case. Previous proposals to cherry pick envelope values from ASRHAIE Standard 90.1 for the last 10 years have more often than not been disapproved.

The values increase the stringency requirements, however there was no energy efficiency/cost analysis presented to substantiate the proposal, as required by ICC Council Policy 28.

In regard to the proponent's citation of ASHRAE Standard 90.1, since the supporters advertised ASHRAE Standard 90.1's methodology as being cost effective and energy efficient then the entire ASHRAE standard 90.1 opaque envelope values should have been presented and brought over in total. However the proponents did not, and therefore we should not encourage cherry picking from other published documents.

In view of the above we ask that this code change proposal be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If approved the cost increase for additional insulation materials will not take effect.

Public Comment# 1717

Public Comment 2:

Proponents:

Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests Disapprove

Commenter's Reason: CE75-19 mistakenly claims to correct errors in the commercial U-factor table, but instead makes a current problem with material neutrality much worse.

Currently in CZ5 both metal and wood frame walls must meet the same performance target – a U-factor of 0.064. This is equitable and material neutral – a core principle of the code. CE75-19 however would reduce the U-factor for wood frame walls by 20 percent to U-0.051 but leave metal frame walls unchanged, creating a huge inequity in the treatment of materials, benefitting metal at the expense of wood.

CE75-19 similarly destroys material neutrality in CZ 7 by reducing the metal frame U-factor by about 20 percent to U-0.042 from U-0.052. U-0.052 is essentially the same as the CZ 7 wood frame U-factor of U-0.051 so the proposed change disadvantages metal compared to wood, thereby eliminating material neutrality.

Approving this public comment will return the IECC, per the preface, to the principles upon which it was founded (emphasis added): "This code is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that **adequately conserves energy**; provisions that **do not unnecessarily increase construction costs**; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that **do not give preferential treatment to particular types or classes of materials, products or methods of construction.**"

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1846

CE79-19

IECC@: C402.2.4, C402.2.4.1 (New)

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Energy Conservation Code

~~**C402.2.4 Slabs-on-grade perimeter insulation. Slabs-on-grade. (Prescriptive)** Where the slab on grade is in contact with the ground, the minimum thermal resistance (*R*-value) of the insulation around the perimeter of for unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3. The perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil.~~

~~**Exception:** Where the slab on grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.~~

Add new text as follows:

C402.2.4.1 Insulation installation (Mandatory). Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

Reason: In the last code cycle, provisions for full-slab insulation were added to Table C402.1.3 for heated slabs. However, Section C402.2.4 only addresses perimeter insulation of slabs. This proposal makes coordinating changes to Section C402.2.4 such that installation of both perimeter insulation and full-slab insulation are addressed in a manner consistent with the intent of Table C402.1.3. The designation of [Prescriptive] and [Mandatory] in the titles is used because the R-values are prescriptive, but the installation requirements should apply to any and all compliance approaches (i.e., mandatory). This approach is also intended to be consistent with a larger proposal expected from SEHPCAC which addresses the prescriptive vs. mandatory matter in other sections of the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The proposal adds installation provisions for fullslab insulation in a manner consistent with Table C402.1.3. The installation provisions provided for full slab insulation may reduce cost for typical slab-on-grade floor construction by explicitly not requiring insulation under structural column footings (although this is possible using high density and compressive strength foam insulating sheathing boards as commonly done for cryogenic facilities and infrastructure frost protection).

Staff Analysis: Please note that the majority of the change is relocating existing text from Section C402.2.4 into C402.2.4.1. Because of the requirements of the cdpACCESS system, the text removed from C402.2.4 must be shown as deleted and then underlined when it reappears in Section C402.2.4.1

CE79-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C402.2.4.1 Insulation installation (Prescriptive Mandatory). Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the

bottom of the heated slab and shall be continuous with the full slab insulation.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

Committee Reason: The proposal provides needed clean up, it is tradable, the modification gives needed flexibility (Vote: 15-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE79-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.2.4, C402.2.4.1 (New), C402.2.4.2 (New)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.2.4 Slabs-on-grade. (Prescriptive) The minimum thermal resistance (*R*-value) of the insulation for unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

C402.2.4.1 Slab-on-grade perimeter insulation installation (Prescriptive Mandatory). Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab in accordance with the proposed design or, where using the R-value method for compliance, for the minimum distance shown in Table C402.1.3 the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil. ~~Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.~~

~~**Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.~~

C402.2.4.2 Slab-on-grade full slab insulation installation [Mandatory] Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation at the perimeter of a slab with full slab insulation shall be installed in accordance with Section C402.2.4.1, shall not be required to extend below the bottom of the slab edge, and shall be continuous with the full slab insulation.

Commenter's Reason: The committee recommended approval with a modification that changed proposed Section C402.2.4.1 to a prescriptive rather than mandatory requirement. The proponent provided the modification because certain aspects of the installation requirements are "tradeable" for lesser or greater performance. However, many of the basic installation requirements are not tradeable and should be considered mandatory. This public comment provides a means to use alternative installation practices by way of a proposed design (the proposed design then defines mandatory installation practice for the project). Thus, installation requirements by way of a proposed design or by use of the R-value method can both be considered mandatory as they should be. Finally, this PC improves the format of the proposal by moving the full-slab insulation installation information into its own subsection with some wording improvements. We request your support to maintain the committee's approval of CE79 as modified by this PC.

NOTE: The key substantive change is the "proposed design" phrase added to Section C402.2.4.1. The remaining changes to CE79 are non-technical and simply move existing text or proposed text to align with a better format for these provisions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Refer to the original proposal's cost impact statement. If anything, this PC makes it clearer that there should be no cost impact by clarifying that alternative installation solutions can be used via a proposed design.

Public Comment# 1755

Public Comment 2:

Proponents:

David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Modified by Committee

Commenter's Reason: SEHPCAC supports the committee action.

Testimony at the committee action hearings revealed that some builders model different insulation installation details which affect prescriptive requirements, making this section 'tradeable.' The hearing committee rightfully identified this as 'tradeable' and therefore **not** mandatory.

In keeping with SEHPCAC's goal of clarifying the distinction between tradeable (prescriptive) and non-tradeable (mandatory) sections, and because these provisions are being 'traded,' this proposal should not be labeled 'mandatory.'

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Per the cost impact statement on the original proposal.

Public Comment# 1709

CE80-19

IECC@: C401.2, C402.2.7, C407.2

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.2.7, C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C402.2.7 Airspaces. Airspaces (Mandatory). ~~Where the thermal properties of airspaces are used to comply with this code~~ R-value of an airspace is used for compliance in accordance with Section ~~C401.2, such airspaces~~ C402.1 the airspace shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is located on the interior side of the continuous air barrier and is bounded on all sides by building components.

Exception: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

C407.2 Mandatory requirements. Compliance with this section requires compliance with Sections C402.2.7, C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404 and C405.

Reason: When C402.2.7 was added in the 2018 edition of the code it required compliance with C401.2, but did not exclude the ASHRAE 90.1 compliance path. Imposing the airspace requirement on designs which do not use Chapter 4, but use ASHRAE 90.1 prevents the 90.1 path from being a standalone path as intended. This is an opportunity for conflict and confusion and complicates training for both the IECC and the 90.1. The reference "in accordance with Section C401.2" could be read to imply that this requirement overlays those of ASHRAE 90.1. The IECC does not make modifications to the ASHRAE 90.1.

Airspaces are proposed to be non-tradeable (mandatory) in the performance path because the IECC's provisions do not include performance metrics, indicating there is no tradable value.

Instead, the IECC's requirements for airspaces are installation related – 'how to do an airspace' – which apply to all installations, prescriptive and performance, which makes the provision mandatory.

While identified as "Mandatory", if the elimination of the use of the labels "prescriptive" and "mandatory" is approved, we understand this label would not be added and it would instead the provision be added to Table C407.2 to indicate its application to the Total Building Performance compliance option.

This proposal is submitted by the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at: <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx> (<http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>)

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This change does not increase or decrease code provisions nor impact construction methods. It clarifies language and provisions already contained in the code.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This provides clarification to the code as to what is mandatory (Vote: 15-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.2.7

Proponents:

Wesley Hall, representing Reflective Insulation Manufacturers Association (RIMA) (wes.hall@reflectixinc.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.2.7 Airspaces (Mandatory). Where the R-value of an airspace is used for compliance in accordance with Section C402.1 the airspace shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is ~~located on the interior side of the continuous air barrier and is bounded on all sides by building components.~~

~~**Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.~~

Commenter's Reason: RIMA-I supports this proposal in concept, provided the revisions proposed in this public comment are approved. It is not necessary to require that the airspace be located on the interior side of the air barrier. The exception is technically incorrect, has no scientific basis, and should be removed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Most of the revisions in both the proposal and public comment are editorial. However, the exception that is being deleted is a highly proprietary and costly test. Deleting this could potentially reduce cost.

CE81-19

IECC@: C402.2, C402.2.8 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

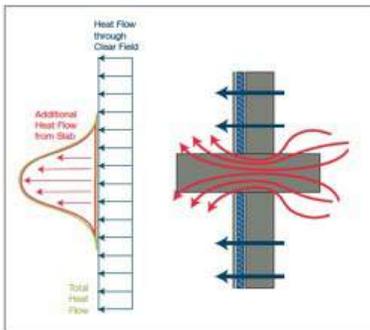
C402.2 Specific building thermal envelope insulation requirements (Prescriptive). Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through ~~C402.2.7~~ C402.2.8 and Table C402.1.3.

Add new text as follows:

C402.2.8 Concrete slab floors. Concrete floor slabs that penetrate the building thermal envelope shall be provided with either continuous insulation having a minimum thermal resistance of R-3 or a minimum R-3 thermal break located where the concrete slab penetrates the building thermal envelope.

Reason: The requirements for overall assembly insulation have been well-addressed in the code. However, the existing requirements do not adequately address significant thermal bridging issues.

Thermal bridges are created when a relatively high thermally conductive material “bridges” through the insulating materials in the thermal envelope. Whether they penetrate all the way from the exterior to the interior of the building or only partially through the thermal envelope, thermal bridges make it easier for heat to travel in or out of the building. The impact of thermal bridges has a greater energy impact than a simple weighted U-factor calculation would suggest. Weighted U-factor calculations assume that heat travels in parallel paths through an assembly. In reality, heat also moves laterally, resulting in additional heat transmission through the assembly.



This has an impact on the heating and cooling loads of the building, as well as on the perceived comfort of space occupants. Humans perceive heat primarily through conduction, then radiation, then convection. So the presence of hot or cold surfaces due to thermal bridges can have a significant impact on thermal comfort. When the thermal envelope has hot or cold spots from thermal bridges, occupants are more likely to feel uncomfortable and respond by over-conditioning the air in the space, creating another source of energy loss.

The common practices of leaving concrete slab floor edges un-insulated and extending structural slabs through the thermal envelope to create balconies are particularly problematic and significant thermal bridges. This proposal addresses this significant issue by requiring that the thermal bridges created by concrete floor slabs that penetrate the building thermal envelope be addressed either by providing them with thermal breaks or by encapsulating them in continuous insulation. There are products available on the market that can be used to provide a thermal break within a continuously poured slab that extends to create a balcony. Alternately, balconies can utilize alternate structural configurations that do not require turning the building into a huge radiator.

Cost Impact: The code change proposal will increase the cost of construction
This will increase the cost of construction. Cost impact will vary depending on the approach taken.

CE81-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Proponent requested disapproval to work with opponent and bring back a public comment (Vote: 15-0).

Assembly Action:

None

CE81-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.2.8 (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.2.8 Peripheral edges of intermediate concrete-slab floors and balconies. ~~Concrete~~ Peripheral edges of intermediate floor slabs and extensions of floors that penetrate the building thermal envelope, including balconies, shall be provided with either continuous insulation having a minimum thermal resistance of R-3 or a minimum R-3 thermal break located where the concrete slab penetrates the building thermal envelope. Continuous applications of Fire safing shall be deemed to comply.

When compliance is in accordance with Section C402.1.5 on component performance alternative, the peripheral edges of intermediate floors and extensions of floors that penetrate the building envelope shall be considered above grade walls.

Exceptions:

1. Buildings located in Climate Zones 1 through 3.
2. Existing buildings or alterations to existing buildings.
3. Uninsulated walls.

Commenter's Reason: The requirements for overall assembly insulation have been well-addressed in the code. However, the existing requirements do not adequately address significant thermal bridging issues.

Thermal bridges are created when a relatively high thermally conductive material "bridges" through the insulating materials in the thermal envelope.

Disapproval was requested for CE81 during the IECC Code Development Hearings to modify and clarify the proposal to specifically address peripheral edges of intermediate floors and balconies, assemblies that are areas of significant thermal bridging.

This Public Comment provides some practical exceptions to bring this proposal in line with ASHRAE with the understanding that the R-3 insulation can be traded-off by using the component performance alternative if there are overriding structural issues that will make it difficult to comply with the R-3 requirement.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This will increase the cost of construction. Cost impact will vary depending on the approach taken. Note that the Component Performance Alternative can be used to trade-off the continuous insulation through increases in efficiencies in other parts of the building envelope that may result in lower construction costs.

Public Comment# 2083

Public Comment 2:

IECC®: C402.2.8 (New)

Proponents:

Martha VanGeem, representing Masonry Alliance for Codes and Standards; Tien Peng, NRMCA, representing NRMCA (tpeng@nrmca.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.2.8 Peripheral edges of intermediate ~~Concrete slab floors~~ and balconies. Peripheral edges of intermediate ~~Concrete floor slabs~~ floors and extensions of floors that penetrate the building thermal envelope, including balconies, shall be provided with either continuous insulation having a minimum thermal resistance of R-3 or a minimum R-3 thermal break located where the ~~floor concrete slab~~ penetrates the building thermal envelope. ~~The insulation and thermal break material are allowed to be interrupted by structural connections and framing. Approved perimeter fire containment systems in accordance with the International Building Code shall be deemed to comply.~~

When compliance is in accordance with Section C402.1.5 on component performance alternative, the peripheral edges of intermediate floors and extensions of floors that penetrate the building envelope shall be considered walls.

Exceptions:

1. Buildings located in Climate Zone 1 through 3.
2. Existing buildings or alterations to existing buildings.
3. Uninsulated walls.
4. Buildings with not more than 20 percent of the gross above-grade wall area as vertical fenestration.
5. Extensions of floors that penetrate the building envelope that provide weather protection at grade, pedestrian, or street level and are at the first story above that level.
6. Extensions of floors and balconies where their total linear length as a percentage of the perimeter of the building on that story are limited to 35% in Climate Zone 4, 30% in Climate Zone 5, 20% in Climate Zone 6, 10% in Climate Zone 7, and 0% in Climate Zone 8.

Commenter's Reason: This modification clears up the vagueness of the original proposal in many ways.

- 1.) The heading and part of the body of the text in the original proposal refer to "concrete slabs floors" or "concrete floor slabs" (they are inconsistent). This is confusing because a "slab" is often thought of as a slab-on-grade floor in the IECC. This proposal does not pertain to "slab-on-grade floors" or "floors above outdoor air or unconditioned space", another type of floor in the IECC. It applies to the edges of intermediate floor slabs, extensions of floor slabs, and balconies.
- 2.) Insulation cannot be used in place of structural connections. Wording was added that insulation can be interrupted by structural connections and framing. Structural engineers need to design balconies for wind and seismic loads. Proprietary balcony thermal break systems, used in Europe and specified by engineers in the U.S. who are interested in reducing thermal bridges, include structural connections to support cantilevered balconies.
- 3.) The joint between the cladding and intermediate floor slab is often filled with fire safing, a kind of insulation that provides enhanced fire protection. This is allowed to be used.
- 4.) Since Section 402.1.5 refers the U-factor, F-factor, and C-factor Table C402.1.4, and peripheral edges of slabs are not included in that table, it needs to be clarified that these edges and the balconies are part of the wall when using this compliance method.
- 5.) Exception 1 for climate zones 1 through 3 is similar to that in ASHRAE 90.1 addendum av on thermal bridges. Thermal bridges are responsible for more heat loss when the change in temperature (delta T) between the inside and outside of the building is greater. So their heat loss is greater in the winter in cold climates, where the delta T can be 60F or more, than in the summer in warm climates, where the delta T is more frequently 20F or less.
- 6.) Exception 2 for existing buildings is similar to that in the latest draft for ASHRAE 90.1 addendum av on thermal bridges. It can be very expensive to retrofit existing buildings to meet this requirement. It could be nearly impossible to retrofit cantilevered concrete balconies without destroying them.
- 7.) Exception 3 for uninsulated walls is similar to that in the ASHRAE 90.1 addendum av on thermal bridges. If a wall is uninsulated, then the intermediate floor is a similar thermal bridge as the wall itself. The intermediate floor edge is small compared to the area of the wall.
- 8.) Exception 4 is added because the glass windows in a building are actually the biggest thermal bridge in the building. A linear foot of glass has about the same heat loss as an intermediate floor. This recognizes that buildings with more opaque walls have more insulation and will often save more energy. The optimal amount of glazing for daylighting is often in the range of 20% of the above grade wall area. ASHRAE 90.1-2016 appendix G, Table G3.1.1-1, sets the baseline percentage of fenestration in the range of 6% for warehouses to 40% for large office buildings. Those individual percentages based on building type could be used here but it would complicate this proposal.
- 9.) Exceptions 5 is similar to that in ASHRAE 90.1 addendum av on thermal bridges. This recognizes the benefit of a covering overhead at building entrances and along sidewalks so that pedestrians can walk without getting wet (or as wet) during rain and snow events.

10.) Exception 6 is similar to that in ASHRAE 90.1 addendum av on thermal bridges. The emphasis here is to allow a small percentage of traditional balconies when this requirement is first introduced to the code for designers, contractors, and code officials to get used to the requirement, and to not ban traditional cantilevered balconies. The buildings that are showcased as the worst offenders have more balconies or overhangs in colder climates than in this exception. Balconies are an amenity in residential construction so that residences have access to the outdoors. One argument for not having any exceptions might be that the requirements can be traded off using COMCheck (that the edge and balconies can be constructed without insulation if COMcheck is used). The fallacy of that is that the prescriptive requirements should be reasonable, practical, and cost effective. Some building owners and contractors just want to know what to do to comply and therefore need reasonable prescriptive requirements. Code officials need to know what compliance looks like.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment only clarifies the original proposal with additional details necessary to contend with the practicalities of insulating peripheral areas in various buildings and construction arrangements. The public comment does not require additional material or labor than what the original proposal intends to require. The original proposal requires insulating of the peripheral areas (which does require added material and labor) and that why the net effect of the public comment and the proposal is an increase in the cost of construction.

Public Comment# 1811

CE87-19

IECC@: TABLE C402.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

**TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS**

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8								
Vertical fenestration																
U-factor																
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29								
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37								
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77								
SHGC																
Orientation ^a	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable
PF < 0.2	0.25 0.23	0.33 0.21	0.25 0.23	0.33 0.23	0.25 0.23	0.33 0.23	0.36 0.33	0.48 0.33	0.38 0.33	0.51 0.33	0.40 0.38	0.53 0.34	0.45 0.40	NR 0.36	0.45 0.40	NR 0.36
0.2 ≤ PF < 0.5	0.30 0.28	0.37 0.25	0.30 0.28	0.37 0.28	0.30 0.28	0.37 0.28	0.43 0.40	0.53 0.40	0.46 0.40	0.56 0.40	0.48 0.46	0.58 0.41	NR 0.48	NR 0.43	NR 0.48	NR 0.43
PF ≥ 0.5	0.40 0.37	0.40 0.34	0.40 0.37	0.40 0.37	0.40 0.37	0.40 0.37	0.58 0.53	0.58 0.53	0.61 0.53	0.61 0.53	0.64 0.61	0.64 0.54	NR 0.64	NR 0.58	NR 0.64	NR 0.58
Skylights																
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR	NR	NR

NR = No Requirement, PF = Projection Factor.

a. "N" indicates vertical fenestration oriented within 45 degrees of true north. "SEW" indicates orientations other than "N." For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.

Reason: The purpose of this code change proposal is to save energy, reduce energy costs and peak demand, and enhance occupant comfort by improving commercial fenestration SHGCs and making the IECC's treatment reasonably consistent with Addendum *aw* to ASHRAE Standard 90.1-2016, which will be part of the published Standard 90.1-2019. The proposal also greatly simplifies compliance with the prescriptive fenestration SHGC requirements in the IECC by adopting ASHRAE's "fixed" and "operable" approach to setting SHGC requirements, in lieu of requiring the user to determine the orientation of each fenestration product in the building in order to apply the IECC's current orientation-specific SHGCs. This proposal also maintains projection factor adjustments that are consistent with the current IECC approach but adjusts them according to the new "fixed" and "operable" distinction. These changes will result in energy savings and peak demand savings in every climate zone, and in many cases may reduce the size of cooling equipment. The proposal will also bring greater consistency between IECC and ASHRAE SHGC requirements while reducing unnecessary confusion.

The commercial IECC's prescriptive approach of incorporating orientation into its SHGC requirement has been unnecessarily complicated in recent years, and it has not provided any real efficiency or compliance benefits. The residential IECC prescriptive path has always applied a single SHGC to fenestration in each climate zone, irrespective of orientation, leaving more sophisticated design choices to the performance path, where it is more appropriate. By contrast, recent editions of the IECC have established orientation-specific SHGCs in the commercial prescriptive path by increasing the SHGC (and reducing efficiency) for northern orientations. The current SHGC division between South/East/West on one hand, and North-facing fenestration on the other, is unnecessary, less efficient, and too complicated for a prescriptive path that is most often used for simple commercial and multifamily buildings. To the extent that design professionals want to incorporate a more sophisticated solar design into a building, a performance compliance approach is a far more appropriate compliance path for such a design. The current orientation-specific SHGCs promote the idea that a design professional should incorporate a higher SHGC on the north-facing walls – an approach that is not only unlikely in practice, but potentially risky, since the wrong windows may be installed on the wrong side of the building. (Note that higher SHGCs on the north side are also less efficient; while a low SHGC is more beneficial on the other orientations, lower SHGCs provide benefits on north orientations as well.)

A better approach has been charted by ASHRAE in Addendum *aw*. ASHRAE sets SHGC requirements based on whether the fenestration is fixed or operable, since operable fenestration typically has larger frames and lower unit SHGCs as a result. ASHRAE does not differentiate the prescriptive SHGC requirements by orientation and has not set an artificially high and unrealistic SHGC for north-facing fenestration, recognizing that the lower SHGC is cost-effective on any side of the building. This approach has the added benefit of improving north-oriented fenestration SHGCs; these lower SHGCs were found by ASHRAE to be cost-effective (there is likely no additional cost associated with the improved SHGCs given the U-factor requirements).

While we would prefer even lower SHGCs in some climate zones, this proposal improves the SHGCs in every climate zone to varying degrees and is a step in the right direction. Low-SHGC fenestration is critically important in commercial buildings because of high daytime occupancy rates and higher internal thermal loads. Reducing solar heat gain will improve occupant comfort and may allow for the installation of smaller cooling equipment, which will not only save building owners money at construction, but again every time the equipment is replaced. Widespread use of low-SHGC fenestration (and the accompanying peak reduction) will also help reduce the need for utilities to build peaking plants or purchase peak electric power, which will ultimately benefit all utility ratepayers.

Cost Impact: The code change proposal will increase the cost of construction

While we believe that many windows currently being installed will already meet or exceed these SHGC requirements, in some cases, the lower SHGCs will require the selection of a more efficient window or the incorporation of other energy efficient measures in the IECC's performance-based compliance options, either of which may increase costs. However, since the SHGC is largely just the result of the choice of low-e coating, there may be no additional cost in most cases. Moreover, any increased glass costs may be more than offset by reduced cooling equipment costs in many cases. In any event, these SHGC values have all been thoroughly considered in ASHRAE's energy and cost-effectiveness analyses. To the extent that the lower SHGCs increase construction costs, based on ASHRAE's work, we expect that these improvements are cost-effective over the useful life of the building.

CE87-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: This proposal is consistent with others the committee has heard - bringing consistency with ASHRAE tables, and the increases in stringency are cost justified (Vote: 15-0).

Assembly Action:

None

CE87-19

Individual Consideration Agenda

Public Comment 1:

IECC@: TABLE C402.4

Proponents:

Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

**TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS**

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8								
Vertical fenestration																
U-factor																
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29								
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37								
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77								
SHGC																
Orientation ^a	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable
PF < 0.2	0.23	0.21-0.23	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33	0.38	0.34	0.40	0.36	0.40	0.36
0.2 ≤ PF < 0.5	0.28	0.25	0.30	0.28	0.30	0.28	0.43	0.40	0.46	0.40	0.46	0.41	0.48	0.43	0.48	0.43
PF ≥ 0.5	0.37	0.34	0.40	0.37	0.40	0.37	0.58	0.53	0.61	0.53	0.61	0.54	0.64	0.58	0.64	0.58
Skylights																
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR	NR	NR

NR = No Requirement, PF = Projection Factor.

Commenter's Reason: While we are supportive of the proposal as whole, we are submitting this public comment for consideration of a single modification to set the SHGC for operable products with a PF < 0.20 in Climate Zone 1, to 0.23 as it is for fixed products in Climate Zone 1. As noted by the proponents in the reason statement, an SHGC of 0.21 may not be problematic for many commercial building applications, however, it can be for sliding glass doors and for hung and sliding windows with narrow frame/sash profiles used in multifamily residential construction as well as other more residential style commercial buildings. While a combination of low-e and tinted glass can be used to achieve 0.21 SHGC, tinted glass is typically not well accepted in any type of residential application. Given operable products are more common for residential applications and the energy savings between products with an SHGC of 0.21 and 0.23 is limited, this modification is reasonable.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. While this proposal may not increase or decrease the cost of construction, it will allow the use of more desirable fenestration products, in particular for residential and residential style construction without a significant compromise in energy efficiency or overall efficiency gains achieved by the 2021 IECC.

CE93-19 Part I

IECC: Part I: C402.4.3, Chapter 6CE (New)\

IECC: Part II: R402.5(N1102.5), Chapter 6RE (IRC Chapter 44) (New)

Proposed Change as Submitted

Proponents: Marc Levitan, representing the ICC 500 Storm Shelter Development Committee; Benchmark Harris representing the National Storm Shelter Association (NSSA) (bharris@huckabee-inc.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C402.4.3 Maximum U-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$PF = A/B$
(Equation 4-5)
where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the farthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device. Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

Exception: The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall not be required in storm shelters complying with ICC 500.

Add new standard(s) as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

ICC 500: ICC/NSSA Standard for the Design and Construction of Storm Shelters

Reason: This proposal is submitted by the National Storm Shelter Association (NSSA) and the ICC 500 Storm Shelter Standard Development committee.

The ICC 500 Standards Development committee is responsible for the development of the ICC/NSSA Standard for the Design and Construction of Storm Shelters. The committee is currently working on the development of the 2020 edition. In 2017 the ICC 500 committee held 7 open conference calls. In addition, there were numerous Working Group meetings and conference calls, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/standards-development/is-stm>.

NSSA was responsible for the development of the original standard for storm shelters in 2001, which ICC 500 replaced through an agreement between ICC and NSSA. Representing General, User and Producer interest categories, NSSA is a technical organization that is committed to promoting consistent quality in both residential and community storm shelters.

Storm windows have a limited availability with the U values required in Section C402.4.3 and C402.5. There is an elevated life-safety concern associated with storm shelters and any window must meet strict missile impact testing and pressure requirements or be protected upon activation of the shelter with shutters.

Cost Impact: The code change proposal will decrease the cost of construction
This modification will increase design options.

Analysis: The referenced standard, ICC 500-2014, is currently referenced in other 2018 I-codes.

CE93-19 Part I

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is insufficient reason to entirely eliminate these requirements. We cannot abridge health requirements, and there are assemblies that can be constructed to comply with the current language (Vote: 15-0).

Assembly Action:

None

CE93-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Submitted

Commenter's Reason: This proposal specifies a specific type of building where more precedent requirements should be utilized. These types of structure are designed to place the occupants in a more safe situation which requires for impact resistant glazing. The U-factor and SHGC requirements and impact resistant requirements may not always be possible.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. Current compliance with the U-factor and SHGC requirements for impact-resistant windows (required for a storm shelter) can be very costly. Providing relief on storm shelter windows can substantially reduce costs of the windows and thus, the cost of construction for storm shelters.

Public Comment# 1789

NOTE: CE93-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE93-19 Part II

IECC: R402.5 (IRC N1102.5), ICC Chapter 06

Proposed Change as Submitted

Proponents: Benchmark Harris, representing National Storm Shelter Association (bharris@huckabee-inc.com)

2018 International Energy Conservation Code

Revise as follows:

R402.5 (IRC N1102.5) Maximum fenestration U-factor and SHGC (Mandatory). The area-weighted average maximum fenestration *U*-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.48 in *Climate Zones* 4 and 5 and 0.40 in *Climate Zones* 6 through 8 for vertical fenestration, and 0.75 in *Climate Zones* 4 through 8 for skylights. The area-weighted average maximum fenestration SHGC permitted using tradeoffs from Section R405 in *Climate Zones* 1 through 3 shall be 0.50.

Exception: The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall not be required in storm shelters complying with ICC 500.

Add new standard(s) as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

ICC 500: ICC/NSSA Standard for the Design and Construction of Storm Shelters

Reason: This proposal is submitted by the National Storm Shelter Association (NSSA) and the ICC 500 Storm Shelter Standard Development committee.

The ICC 500 Standards Development committee is responsible for the development of the ICC/NSSA Standard for the Design and Construction of Storm Shelters. The committee is currently working on the development of the 2020 edition. In 2017 the ICC 500 committee held 7 open conference calls. In addition, there were numerous Working Group meetings and conference calls, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/standards-development/is-stm>.

NSSA was responsible for the development of the original standard for storm shelters in 2001, which ICC 500 replaced through an agreement between ICC and NSSA. Representing General, User and Producer interest categories, NSSA is a technical organization that is committed to promoting consistent quality in both residential and community storm shelters.

Storm windows have a limited availability with the U values required in Section C402.4.3 and C402.5. There is an elevated life-safety concern associated with storm shelters and any window must meet strict missile impact testing and pressure requirements or be protected upon activation of the shelter with shutters.

Cost Impact: The code change proposal will decrease the cost of construction
This modification will increase design options.

Analysis: The referenced standard, ICC 500-2014, is currently referenced in other 2018 I-codes.

CE93-19 Part II

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: These are specific building uses and a reasonable relaxation of window requirements (Vote: 10-1).

Assembly Action:

None

CE96-19

IECC: C202 (New), C402.5, C402.5.1, C402.5.1.2, C402.5.1.2.3 (New)

Proposed Change as Submitted

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gayathri@swinter.com); Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

TESTING UNIT ENCLOSURE AREA. The area sum of all the boundary surfaces that define the dwelling unit, sleeping unit, or occupiable conditioned space including top/ceiling, bottom/floor, and all side walls. This does not include interior partition walls within the dwelling unit, sleeping unit, or occupiable conditioned space. Wall height shall be measured from the finished floor of the conditioned space to the finished floor or roof/ceiling air barrier above.

Revise as follows:

C402.5 Air leakage—thermal envelope (Mandatory). The ~~building~~ thermal envelope ~~of buildings~~ shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft² (2.0 L/s • m²). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be ~~permitted to be~~ located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in Climate Zone 2B.

C402.5.1.1 Air barrier construction. The continuous air barrier shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.8. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

C402.5.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.3.

Exception: Buildings in Climate Zones 2B, 3C, and 5C.

2. Buildings or portions of buildings including Group R and Group I occupancy in Climate Zones 3C and 5C shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

3. Buildings or portions of buildings other than Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

C402.5.1.2.1 Materials. Materials with an air permeability not greater than 0.004 cfm/ft² (0.02 L/s • m²) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than $\frac{3}{8}$ inch (10 mm).
2. Oriented strand board having a thickness of not less than $\frac{3}{8}$ inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m³) and having a thickness of not less than $1\frac{1}{2}$ inches (38 mm).
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m³) and having a thickness of not less than 4.5 inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
8. Cement board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
9. Built-up roofing membrane.
10. Modified bituminous roof membrane.
11. Fully adhered single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $\frac{5}{8}$ inch (15.9 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.
16. Solid or hollow masonry constructed of clay or shale masonry units.

C402.5.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft² (0.2 L/s • m²) under a pressure differential of 0.3 inch of water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E2357, ASTM E1677 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.
3. A Portland cement/sand parge, stucco or plaster not less than $\frac{1}{2}$ inch (12.7 mm) in thickness.

Add new text as follows:

C402.5.1.2.3 Dwelling and sleeping unit enclosure testing The building thermal envelope shall be tested in accordance with ASTM E 779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.30 cfm/ft² (1.5 L/s m²) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. Where any tested unit exceeds the maximum air leakage rate, an additional 20 percent of units shall be tested, including a mixture of testing unit types and locations.

Reason: Air leakage can be a significant source of energy waste in buildings, contributing to higher heating and cooling costs for building owners and occupants, and increasing risk related to comfort and durability. Air tightness testing can result in more attention to air barrier sealing and significantly reduced building leakage. Currently, the residential energy code requires air tightness testing for residential buildings three stories and less in height to ensure proper tightness and a controlled indoor environment. However, in the commercial energy code there is no testing requirement for residential buildings four stories or more in height (e.g., apartments, dormitories, hotel guest rooms). Industry standards affecting these buildings have historically relied upon visual verification, as well as material and assembly requirements. Providing adequate control over air leakage can also allow many benefits, including reduced HVAC equipment sizing, better building pressurization, and energy savings due to reduced heating and cooling of infiltrated outside air. In moist climates, ensuring lower leakage through testing can also result in better humidity control and reduced risk of durability issues.

Air barrier testing saves energy by reducing infiltration of outside air into and out of the building. Most of the time, outside air is hotter or colder than the comfort temperature being maintained in the residence by the heating and cooling systems. Therefore, reducing the infiltration will reduce energy use for heating and cooling. This proposal would require that blower door testing be applied to a sample of units or occupiable spaces in a multiple unit residential construction project. The equipment and staff required are the same as are needed in current air leakage testing required under the residential energy code.

Why is building leakage testing superior to other approaches?

While it is important that the materials and assemblies have limited leakage, specification by individual materials and assemblies does not necessarily equate to an air-tight building. Recent research (Wiss 2014) shows that 40% of buildings constructed without an envelope consultant have air leakage exceeding the current optional test standard of 0.40 cfm/ft² at 75 Pa, while buildings with envelope consultants had leakage below 0.25 cfm/ft² at 75 Pa. Requiring testing will ensure that the goal of this section of the code—limiting unintended air infiltration in buildings—is achieved.

What strategies are considered to minimize compliance burdens in the field?

To manage testing cost, a testing approach is proposed that requires only 20% of the units (with a seven-unit minimum) to be tested in the building. The testing method is also an unguarded test of individual units that reduces cost significantly compared to whole building testing or guarded unit testing. To motivate high-quality air sealing, additional testing of an additional 20% of the units would be required if any unit exceeds the leakage limit. Then the weighted average of tested units is used for comparison to the required leakage limit. While the testing requirement is slightly less stringent than the residential code, it matches current optional commercial requirements and is an improvement over the current condition of no testing requirements in the commercial code. It also provides a more reasonable target than air changes per hour for these units, which are typically smaller and have less total leakage than detached residences.

Are there existing codes and standards that require similar testing measures?

This proposal is similar to the residential air leakage provisions in the 2018 IECC in that it also requires the use of ASTM E 779. The proposal is similar to air leakage testing that is required by the State of Washington and City of Seattle commercial building energy codes as well as procedures followed by the U.S. Department of Defense for testing of commercial buildings. The City of Seattle requirements have been in place since 2009 and hundreds of commercial buildings have been tested under that code, including many large buildings. Additionally, thousands of dwelling units have successfully been tested and achieved this metric through the USGBC's LEED for Homes Multifamily Mid-Rise program and the EPA's ENERGY STAR Multifamily High Rise program. It will also be a required test in ASHRAE 62.2-2019.

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Wiss J. 2014. *ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings*. Elstner Associates, Inc. for ASHRAE. <https://web.ornl.gov/sci/buildings/conf-archive/2013%20B12%20papers/186-Brennan.pdf>

Cost Impact: The code change proposal will increase the cost of construction

PNNL performed a cost-effectiveness analysis to identify the net impacts associated with the proposal using the established DOE methodology (Hart and Liu 2015). Results of the cost-effectiveness analysis indicate that the average savings-to-investment ratio (SIR) and simple payback (SPP) for unguarded dwelling unit testing with a limit of 0.30 cfm/ft² (1.5 L/s · m²) at a pressure differential of 0.2 inch water gauge (50 Pa) in mid-rise apartment buildings were:

· SIR: 7.8; cost-effective if greater than 1.0

· SPP: 5.3 years; cost-effective if less than 40 year life

A measure is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. The cost for individual unguarded unit testing is expected to be significantly lower than the cost for whole building testing, especially with the sampling protocol provided. Results of the cost-effectiveness analysis were taken into account when developing this proposal (i.e., the recommended language only targets building types and climate zones where the testing requirement was determined to be cost-effective).

For buildings already conducting whole-building testing as their compliance option, this may decrease the cost of construction. For buildings not conducting testing, this is an increase in costs to perform the tests. This proposal however does not require more than what is currently required in the residential IECC for similar types of commercial buildings 3 stories and lower.

CE96-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C402.5.1.2.3 Dwelling and sleeping unit enclosure testing. The building thermal envelope shall be tested in accordance with ASTM E 779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.30 cfm/ft²(1.5 L/s · m²) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. ~~For each~~ ~~Where any~~ tested unit that exceeds the maximum air leakage rate, an additional ~~20 percent of~~ units shall be tested, including a mixture of testing unit types and locations.

Committee Reason: This is a successful cost effective methodology which will decrease the stack effect in medium and high rise multi-family. There is no reason to limit testing to an arbitrary 3 stories or less. The modification provides clarification and a more reasonable threshold (Vote 14-1).

Assembly Action:

None

CE96-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.5.1.2

Proponents:

Martha VanGeem, self, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.2 Air barrier compliance . A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.3.
Exception: Buildings in Climate Zones 2B, 3C, and 5C.
2. Buildings or portions of buildings that do not comply with C402.5.1.2.3 including Group R and Group I occupancy in Climate Zones 3C and 5G shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
- ~~3. Buildings or portions of buildings other than Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.~~

Commenter's Reason: There are two paths of compliance in C402.5 -- detailed continuous air barrier requirements in Sections C402.5.1 through C402.5.8 OR testing and C402.5.5 through C402.5.7. In the original proposal, the testing requirements have been inserted into Section C402.5.1 (as section C402.5.1.2.3) which is the air barrier requirements for when testing is not required. The original proposal should have changed the charging language in C402.5 to clarify when testing is required and not put the testing requirements within path where no testing is required (C402.5.1 and C402.5.1.2).

Here is the text from C402.5:

The building thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, OR the building thermal envelope shall be tested...
... Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

This public comment includes the original intent of the section – that if testing is performed (C402.5.1.2.3), then the materials and assembly requirements C402.5.1.2.1 and C402.5.1.2.2 do not need to be demonstrated. Requiring buildings to comply with C402.5.1.2.3 as well as C402.5.1.2.1 and C402.5.1.2.2 would increase costs unnecessarily and conflict with the charging paragraph of C402.5.

Bullets (2.) and (3.) can be combined to be applied to all buildings. The use of the word "including" is not clear in bullet (2.). It can mean including Group R and I and other buildings as well.

To clean up the text, clarify the text, and make it consistent with the language in C402.5, the new item (2.) applies to all buildings. The exception under C402.5.1 already provides an exemption for Climate Zone 2B.

Hopefully it is still clear from the charging paragraph of Section C402.5 that compliance with sections C402.5.2, C402.5.3, C402.5.4, and C402.5.8 is not required when testing according to C401.5.1.2.3 is used for compliance.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The public comment is only a clarification that does not add (or subtract) materials or labor costs. Because the original proposal increases the cost of construction, the net effect of both is an increase in the cost of construction.

Public Comment# 1887

Public Comment 2:

Proponents:

Duane Jonlin, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests Disapprove

Commenter's Reason: Please disapprove CE96 for dwelling unit compartmentalization testing.

Pressure testing of individual apartment units does not relate to envelope air leakage or it's associated energy loss. More air typically leaks through apartment's interior partitions, floor, and ceiling than through the exterior wall.

Air movement between apartments is a matter for a green code or building code, but is not in the scope of the IECC.

The only condition where compartmentalization testing is warranted is for apartments that are accessed via balconies directly from the exterior, so that whole-building testing is not warranted. Therefore, if the membership prefers to keep this change to accommodate that specific circumstance, the third sentence in C402.5.1.2.3 should be modified to read:

"Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, and the individual dwelling or sleeping units are accessed directly from the building exterior, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area."

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Because this public comment would result in no code change there is no impact to cost.

Public Comment# 2022

Public Comment 3:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Disapproval in support of CE97-19 which is more in line with the current code provisions and supported by the testing used as the basis of both CE96-19 and CE97-19. Testing and cost data for both proposals, which is based on testing of commercial buildings, did not include testing of R and I occupancies has no bases. The proposed change CE96-19 which includes testing of R and I occupancies should be disapproved.

The requirements for testing of dwelling units in CE96-19 is also in error. The testing procedure does not include a requirement that the air testing shall be to determine the air leakage to the building exterior (which is what the concern is) vs. testing the air leakage of the individual unit, which if not done properly, could include leakage to adjoining units to the side, below, above and to the interior of the building.

CE96-19 and CE97-19 also include supporting information stating that 40% of the buildings constructed without an envelope consultant have air

leakage exceeding the current optional test standard of 0.40 cfm/ft² at 75 PA. In other words, 60% of the buildings with an envelope consultant pass the test. Clearly, the simple solution, other than testing, is to use an envelope consultant to ensure that the building envelope meets the requirements of Section C402.5.1.2.1 Materials or C402.5.1.2.2 Assemblies as required by current code and CE97-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1194

CE97-19

IECC@: C402.5, C402.5.1, C402.5.1.2, C402.5.1.2.3 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

C402.5 Air leakage—thermal envelope (Mandatory). The ~~building thermal envelope of buildings~~ shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ~~ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft² (2.0 L/s · m²).~~ Section C402.5.1.2.3. Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be ~~permitted to be~~ located on the inside or outside of the building ~~thermal~~ envelope, located within the assemblies composing the ~~building thermal~~ envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in Climate Zone 2B.

C402.5.1.2 Air barrier ~~compliance options~~ compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including group R and group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
2. Buildings or portions of buildings of other than group R and group I occupancy shall meet the provisions of Section C402.5.1.2.3.

Exceptions:

1. Buildings in Climate Zones 2B, 3B, 3C, and 5C.
 2. Buildings larger than 5000 square feet floor area in Climate Zones 0B, 1, 2A, 4B, and 4C.
 3. Buildings between 5000 and 50,000 square feet floor area in Climate Zones 0A, 3A and 5B.
3. Buildings or portions of buildings other than group R and group 1 occupancy that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

Add new text as follows:

C402.5.1.2.3 Non-residential building thermal envelope testing The building thermal envelope shall be tested in accordance with ASTM E 779 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft² (2.0 L/s · m²) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area-weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade, and
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft² (2.0 L/s·m²) but does not exceed 0.60 cfm/ft² (3.0 L/s·m²), a diagnostic evaluation using smoke tracer or infra-red imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with satisfy the requirements of this section.

Reason: Air leakage can be a significant source of energy waste in buildings, contributing to higher heating and cooling costs for building owners and occupants, and increasing risk related to comfort and durability. Air tightness testing can result in more attention to envelope assembly air barrier sealing and significantly reduced building leakage. Currently Section C402.5 Air Leakage – thermal envelope, allows air tightness testing as an alternative to meeting material or assembly selection and installation method requirements to ensure proper tightness and a controlled indoor environment. Adequate control over air leakage can provide many benefits, including reduced HVAC equipment sizing, better building pressurization, and energy savings due to reduced heating and cooling of infiltrated outside air. In moist climates, ensuring lower air leakage through whole-building testing can also result in better humidity control and reduced risk of durability issues.

While it is important that the materials and assemblies have limited leakage, that alone does not guarantee a low leakage building. Recent research (Wiss 2014) shows that 40% of buildings constructed *without* an envelope consultant have air leakage exceeding the currently optional test standard requirements, while buildings with envelope consultants all had leakage below 0.25 cfm/ft². Testing is the most reliable means of ensuring that the intent of this code section—limiting unintended energy waste in buildings due to air infiltration—will be achieved.

The measure retains the current IECC optional compliance path test limit of 0.40 cfm/ft² at 75 Pa. Since mandatory—rather than optional—testing would be a new requirement, it is appropriate to retain the current and higher limit of 0.4 cfm/ft² for improved building industry acceptance. Durston and Heron's review (2012) of the more stringent requirements by the U.S. Department of Defense (DOD) shows that without testing, the range of building leakage can exceed the requirement by more than double (0.9 cfm/ft²). However, with testing included as part of the construction process, the average leakage of buildings was determined to be well below the 0.4 cfm/ft² limit. Therefore, based on the DOD findings, the test limit of 0.40 cfm/ft² is considered a realistic and achievable goal. In addition, the target is well established in the IECC, and aligns with similar optional requirements contained in Standard 90.1.

Intent of the Code Change Proposal

This code change proposal will require

- The leakage testing thresholds are the same as current optional testing thresholds.
- Proposed requirements for testing vary by climate zone and building size and are based on industry-accepted cost-effectiveness analysis methods.
- As outlined in the optional compliance path, portions of buildings could be tested on a sampling basis.
- Commercial buildings under 5000 square feet can be tested using residential methods, technicians, and equipment with the maximum leakage rate set at 0.30 cfm/ft² (1.5 L/s · m²) at 0.2 in. w.g. (50 Pa). This testing pressure differential is common for residential testing, and is equivalent to a leakage rate of 0.40 cfm/ft² (1.5 L/s · m²) at 0.3 in. w.g. (75 Pa), the current alternative commercial test limit. Yet, implementing the residential procedure can dramatically reduce testing costs for these smaller buildings.
- Since this would be a new requirement, a backup exception is provided so that if a building fails the 0.40 cfm/ft² test, the building can still pass the requirement as long as the tested value is below 0.60 cfm/ft² and additional diagnostics are performed.

Climate Zones 0A and 0B are included in the code change proposal assuming that a code change proposal submitted by SEHPCAC to update the climate zones is submitted and approved. These climate zone designations can be removed from the proposal with no impact if the climate zones are not updated.

What strategies are considered to minimize compliance burdens in the field?

Three specific strategies are applied to minimize the impact of testing on building project costs:

- Testing is only required for certain building types and climate zones where analysis indicates it is cost-effective and the savings justifies the cost. Based on that analysis, size thresholds by climate zone are provided for non-residential buildings.
- It is also prudent to provide some flexibility in the test standard to allow for building industry acceptance and a transition to meeting a fixed testing requirement. Specifically, when the building envelope is complete and testing occurs, access to the air barrier for repairs is difficult. Thus, an exception is included that allows the tested leakage rate to be no more than 0.6 cfm/ft² as long as specific remediation efforts are made. This exception is meant to provide a modest relaxation of the requirement, but only if significant corrective actions are taken that may reduce the air leakage.
- As an additional strategy, the measure allows representative portions or a sample of spaces in the building to be tested instead of the whole building. This alternative supports more economical testing of large buildings, which can help reduce the compliance burden and is consistent with similar requirements in ASHRAE 90.1-2016.

Existing Codes and Standards that Require Similar Testing Measures

The measure is consistent with air leakage testing requirements and thresholds required by the State of Washington and City of Seattle commercial building energy codes (SDCI Community Engagement 2012), as well as procedures followed by the DOD for testing of commercial buildings referenced above. The City of Seattle requirements have been in place since 2009, and hundreds of commercial buildings have been tested under that code, including many large buildings. The proposed measure is less stringent than the current DOD requirements (0.25 cfm/ft²), and case studies (Durston and Heron 2012) have shown that much lower leakage levels—in the range of 0.15 cfm/ft²—can be achieved.

Energy Savings

An analysis of energy impact shows that annual energy savings from air barrier improvement resulting from testing due to the measure ranges from \$5.07 to \$71.88 per thousand square feet of floor area in offices in climate zones where testing is recommended. More details are found in the cost-effectiveness analysis referenced in the Appendix.

Cost-effectiveness: Pacific Northwest National Laboratory performed a cost-effectiveness analysis using the established DOE methodology (Hart and Liu 2015). Results of the analysis indicate that the average savings-to-investment ratio (SIR) and simple payback period (SPP) for commercial building testing with a limit of 0.40 cfm/ft² (1.5 L/s · m²) at a pressure differential of 0.3 inch w.g. (50 Pa) in office buildings vary by size, as shown in the table below.

Building size range, floor area square feet	<5000	5000 to 50,000	>50,000
Average SIR	7.3	2.2	3.2
Average SPP (years)	7.1	13.1	10.2

A measure is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. Under ASHRAE 90.1 criteria, cost-effectiveness is proven when the simple payback is shorter than the scalar threshold of 22.2 years. Based on the cost-effectiveness analysis results, air barrier testing is specified for buildings that have both an SIR greater than 1 and a simple payback that is less than the 90.1 scalar threshold based on climate zone and building size.

As a result of breaks in cost assumptions, most climate zones qualify for testing for buildings below 5000 square feet, with fewer climate zones requiring testing for buildings larger than 50,000 square feet, and the fewest climate zones requiring testing for buildings between 5000 and 50,000 square feet.

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Cost Impact: The code change proposal will increase the cost of construction

This measure will increase the cost of construction of new commercial buildings as whole building air leakage testing will be required except for primarily residential buildings (Group R and I building occupancies). Based on a survey of professional commercial building air barrier testing companies, it was determined that the cost of air leakage testing fell into three ranges:

- \$350 or \$0.12 to \$0.07 per square foot for buildings up to 5000 square feet
- \$0.50 to \$0.15 per square foot for buildings between 5000 and 50,000 square feet
- \$0.15 to \$0.09 per square foot for buildings between 50,000 and 100,000 square feet, with decreasing costs for larger buildings.

As demand for air leakage testing in commercial buildings increases, more companies will enter the market to provide these services. Therefore, a gradual decrease in cost is expected as more companies are available to do the testing.

Public Hearing Results

Committee Action:**Committee Modification:**

C402.5.1.2 Air barrier compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including group R and group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
2. Buildings or portions of buildings of other than group R and group I occupancy shall meet the provisions of Section C402.5.1.2.3.

Exceptions:

Buildings in Climate Zones 2B, 3B, 3C, and 5C.

Buildings larger than 5000 square feet floor area in Climate Zones 0B, 1, 2A, 4B, and 4C.

Buildings between 5000 and 50,000 square feet floor area in Climate Zones 0A, 3A and 5B.

3. Buildings or portions of buildings other than group R and group I occupancy that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

C402.5.1.2.3 Non-residential Building thermal envelope testing. The building thermal envelope shall be tested in accordance with ASTM E 779, ANSI/RESNET/ICC 380, or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft^2 ($2.0 \text{ L/s} \cdot \text{m}^2$) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area-weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof,
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade, and
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft^2 ($2.0 \text{ L/s} \cdot \text{m}^2$) but does not exceed 0.60 cfm/ft^2 ($3.0 \text{ L/s} \cdot \text{m}^2$), a diagnostic evaluation using smoke tracer or infra-red imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with satisfy the requirements of this section.

Committee Reason: This is a conservative step that that has already been shown to be cost effective, it provides an alternative for very large buildings in testing a portion. The modifications correct the occupancy type and clarify building type that can use the method and additional testing standard (Vote: 12-3).

Assembly Action:**None**

Staff Analysis: Standard ASTM E1827 is already a referenced standard in this code. Standard ANSI/RESNET/ICC 380 is already referenced in another I-Code, specifically the IECC-Residential provisions.

CE97-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.5.1.2

Proponents:

Martha VanGeem, self, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.2 Air barrier compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

~~1. Buildings or portions of buildings including group R and group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.~~

~~2.1. Buildings or portions of buildings of other than group R and group I occupancy shall meet the provisions of Section C402.5.1.2.3.~~

Exceptions:

1. Buildings in Climate Zones 2B, 3B, 3C, and 5C.
2. Buildings larger than 5000 square feet floor area in Climate Zones 0B, 1, 2A, 4B, and 4C.
3. Buildings between 5000 and 50,000 square feet floor area in Climate Zones 0A, 3A and 5B.

~~3.2. Buildings or portions of buildings other than group R and group I occupancy that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.~~

Commenter's Reason:

There are two paths of compliance in C402.5 -- detailed continuous air barrier requirements in Sections C402.5.1 through C402.5.8 OR testing and C402.5.5 through C402.5.7. In the original proposal, the testing requirements have been inserted into Section C402.5.1 (as section C402.5.1.2.3) which is the air barrier requirements for when testing is not required. The original proposal should have changed the charging language in C402.5 to clarify when testing is required and not put the testing requirements within path where no testing is required (C402.5.1 and C402.5.1.2).

Here is the text from C402.5:

The building thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, OR the building thermal envelope shall be tested...
... Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

This public comment includes the original intent of the section – that if testing is performed (C402.5.1.2.3), then the materials and assembly requirements C402.5.1.2.1 and C402.5.1.2.2 do not need to be demonstrated. Requiring buildings to comply with C402.5.1.2.3 as well as C402.5.1.2.1 or C402.5.1.2.2 would increase costs unnecessarily and conflict with the charging paragraph of C402.5.

The original bullet item (1.) conflicted with the original bullet item (3.) because the original item (1.) could be read to include all "buildings or portions of buildings". "Including" is a subset of all buildings but doesn't disallow all buildings. It's meaning and use is confusing here.

To clean up the text, clarify the text, and make it consistent with the charging language in C402.5, the new item (2.) applies to all buildings and allows either testing OR compliance with C405.1.2.1 or C405.1.2.2.

Hopefully it is still clear from the charging paragraph of Section C402.5 that compliance with sections C402.5.2, C402.5.3, C402.5.4, and C402.5.8 is not required when testing according to C401.5.1.2.3 is used for compliance.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The public comment is only a clarification that does not add (or subtract) materials or labor costs. Because the original proposal increases the cost of construction, the net effect of both is an increase in the cost of construction.

Public Comment# 1896

Public Comment 2:

Proponents:

Duane Jonlin, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests As Modified by Committee

Commenter's Reason: Please support the Committee decision to require testing of air barriers.

The current code does little to control air leakage, because the problem is *not* air leaking right through the materials and assemblies themselves, but rather through the joints between these elements and penetrations through them. These leaks cannot be located or measured by visual inspection - the only way to know how much air is leaking through your building, and to start reducing that leakage, is to actually test it.

Air barrier tightness improves dramatically as soon as the trades involved know that the test will take place, simply because everyone is paying closer attention. Our experience here in Washington state is that buildings can pass easily, and we are now in the process of tightening up the test standard even further.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a supportive comment, not involving a change in cost.

Public Comment 3:**Proponents:**

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: There is no real justification for this proposal. The envelope in larger buildings will be designed by licensed architects, usually with tested designs. The envelope is also inspected by the jurisdiction to ensure it is done per the design, code, and to ensure it is properly sealed. The proponents mention that there are not that many testers currently available, but if this is passed then there will be more, that is a reason not to allow this to move forward, the resources are not available at this time.

There are many buildings where this is just not feasible. Think about a large warehouse with multiple dock doors, some with close to 100 dock doors. Aircraft hangers and other manufacturing facilities. This proposal gives no exceptions for buildings with lower energy usage, or for high performing buildings.

A typical large distribution warehouse would cost (using the cost provided) over \$270,000 for this test. This is another cost that is not needed, especially on small buildings which are using typical construction methods that don't meet the exceptions. Speaking of exceptions, if envelope testing is so beneficial there should be no exceptions. This is a huge hardship for small business, especially in smaller more out of the way jurisdictions that do not have the contractors readily available, if they have to travel far, the cost will surely increase beyond what is in the reason statement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

CE99-19

IECC@: C103.2, C402.5.1, C402.5.1.3 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

C103.2 Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of *daylight* zones on floor plans.
12. Air ~~sealing details~~ barrier and air sealing details, including the location of the air barrier.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1, C402.5.1.2 and ~~C402.5.1.2~~, C402.5.1.3.

Exception: Air barriers are not required in buildings located in *Climate Zone 2B*.

Add new text as follows:

C402.5.1.3 Building envelope performance verification. The installation of the continuous air barrier shall be verified by a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. A final commissioning report shall be completed by the registered design professional or approved agency and provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures used.

Reason: The testing path for infiltration in the IECC requires a leakage rate of 0.40 CFM/sf @ 75PA. However, according to "Achieving the 30% Goal: Energy and Cost Savings Analysis of ASHRAE Standard 90.1-2010" prepared by the Pacific Northwest National Lab, the prescriptive air barrier requirements currently used in the IECC only achieve 1.0 CFM/sf @ 75Pa. The prescriptive path is therefore not achieving the level of performance achieved by the testing path. The code requires that air barrier materials meet 0.40 CFM/sf @ 75Pa, so the issue must be with installation and not the materials themselves. This proposal narrows that gap by requiring verification of the air barrier during construction and reporting back to the owner and code official in a manner similar to existing acceptance testing requirements, thereby ensuring better air barrier installation without actually requiring testing.

The proposal includes a sequence of requirements to ensure both effectiveness, ease of implementation and ease of enforcement. Key among these is a requirement that the inspection occur while remediation of errors can still be remedied. Submission of the report to the code official and the owner will ensure that the process has been followed.

The proposal also modifies the charging language in C402.5 and the construction documentation requirements in C103 to enable the new

requirements.

According to Evan Mills, PhD, a researcher at Lawrence Berkeley National Laboratory, savings associated with using BECx from both maintenance and energy savings average about 16% for existing buildings and 13% for new construction ("Calculating the ROI of building enclosure commissioning." *Building Design + Construction*. June 28, 2013.)

Cost Impact: The code change proposal will increase the cost of construction

Evan Mills, PhD, a researcher at Lawrence Berkeley National Laboratory studied the benefits of BECx, noting that commissioning only costs about \$1.16/sf for new construction and \$0.30/sf for existing buildings on average, with a payback period of as little as 14 months.

CE99-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C402.5.1.3 Building envelope performance verification. The installation of the continuous air barrier shall be verified by the code official, a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Section C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. A final commissioning report shall be provided for inspections completed by the registered design professional or approved agency. ~~and~~ The commissioning report shall be provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures ~~used~~ taken.

Committee Reason: This proposal fills an important gap, and provides an exemption for those buildings that were tested - it fills gap in prior approvals. The modification provides an important addition, allowing building official to provide verification (Vote: 14-1).

Assembly Action:

None

CE99-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.5.1.3 (New)

Proponents:

David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.3 Building envelope performance verification. The installation of the continuous air barrier shall be verified by the code official, a registered design professional or approved agency in accordance with the following:

1. ~~A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.~~
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. ~~A final commissioning report shall be provided~~ For inspections completed by the registered design professional or approved agency a final

~~commissioning report shall be provided. The and the~~ commissioning report shall be provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken.

Commenter's Reason: Requiring a review of the construction documents is not necessary as all construction documents are required to be reviewed to determine compliance with the ICC Codes.

The changes proposed make it clear that when the inspections are performed by the registered design professional or approved agency would require a commissioning report and that it is provided to the owner and code official. With this change, and the changes by the committee it will be clear that the owner can rely on the building inspector to provide the necessary verification.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The modification will simply clarify how the verification is to be performed and will have no cost impact.

Public Comment# 2005

Public Comment 2:

IECC@: C103.2, C408.4 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C103.2 Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of *daylight* zones on floor plans.
12. Air barrier and air sealing details, including the location of the air barrier.

~~C402.5.1.3~~ **C408.4 Building envelope performance verification.** The installation of the continuous air barrier shall be verified by a registered design the code official, a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while there is still ready access to the air barrier ~~is still accessible~~ for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. A final commissioning report shall be provided for inspections completed by the registered design professional or approved agency. The commissioning report shall be provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken..

Commenter's Reason: This proposal has great merit, but it was originally located in the wrong section. This new section should be located in the commissioning section.

The change from 'accessible' to 'ready access' is for editorial consistency with CE29-19 Part II which was approved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Relocation of sections in the code are nearly editorial and as such, have no cost impact. Although the proposal indicated a cost increase, that may not be necessarily accurate for all projects because normally, the required inspections and report generation are already occurring.

Public Comment# 1793

Public Comment 3:

IECC@: C402.5.1.3 (New)

Proponents:

Martha VanGeem, self, representing Masonry Alliance for Codes and Standards; Margo Thompson, representing National Multifamily Housing Council (mthompson@newportventures.net); Emily Lorenz, representing PCI (emilyblorenz@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.3 Building envelope performance verification. The design and installation of the continuous air barrier shall be verified by a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. A final commissioning report shall be completed by the registered design professional or approved agency and provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures used.

Exception: Where the building thermal envelope meets the air leakage testing requirements of Section C402.5 and the testing report is provided to the building owner or owner's authorized agent and the code official, inspection of the continuous air barrier during construction by a registered design professional is not required.

Commenter's Reason: There are two paths of compliance in C402.5 -- detailed continuous air barrier requirements in Sections C402.5.1 through C402.5.8 OR testing and C402.5.5 through C402.5.7.

Inspection of continuous air barrier components and assemblies during construction by a registered design professional should not be required when testing meets the requirements of Section C402.5. This is an added cost in addition to the cost of testing.

- So, this public comment adds an exception that inspection during construction by a registered design professional is not required when the testing meets the requirements.

When testing is used for compliance, the report needs to be provided.

It is confusing whether this entire section C402.5.1.3 is required when testing is the path for compliance. Section C402.5.1 was not originally for the testing path (see the charging language for C402.5 and above description). Yet, the testing requirements have been put into Section C402.5.1 for some of the proposals (CE96 and CE97). Therefore, this text clarifies what is required.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The public comment is only a clarification that does not add (or subtract) materials or labor costs. Because the original proposal increases the cost of construction, the net effect of both is an increase in the cost of construction.

Public Comment# 1544

Public Comment 4:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: Air barrier third party verification is not necessary. This is another burdensome item on the contractor and owner. This would cost an owner of a large warehouse an additional 2+ million dollars to comply. The code already requires sealing, and the professional designer will ensure their design meets code. The jurisdiction should be inspecting this already too. In the reason statement it says there is a 14 month payback, will an owner really see a 2+ million dollar payback in 14 months?

Building envelope performance verification should be a trade-off or option, this should not be mandated. What benefit is there to requiring the code official to receive this report. I can see issues with the final report, will a jurisdiction now require verification of any deficiencies noted, to ensure they were corrected and will they trust the person to verify compliance?

This also gives no exception to buildings build with traditional and proven methods of construction. I can think of a prototypical chain food restaurant, they know their buildings, and have built thousands of them, what benefit is there to require someone on site to do another inspection. This can also cause a delay in construction because of the availability of qualified people to conduct this verification. What makes a person qualified? Allowing the code official is a good step, that provision was approved as modified. However, on large projects, the code official will not have enough time to do this while it is being constructed. As such, it will still require hiring a third party inspector or paying the architect to perform the verification.

This should not be mandatory, it should be a trade-off or an option.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1321

Proposed Change as Submitted

Proponents: donald sivigny, State of MN, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Energy Conservation Code

Delete without substitution:

~~C402.5.3 Rooms containing fuel-burning appliances.~~ In *Climate Zones* 3 through 8, where combustion air is supplied through openings in an exterior wall to a room or space containing a space-conditioning fuel-burning appliance, one of the following shall apply:

- ~~1. The room or space containing the appliance shall be located outside of the *building thermal envelope*.~~
- ~~2. The room or space containing the appliance shall be enclosed and isolated from conditioned spaces inside the building thermal envelope. Such rooms shall comply with all of the following:~~
 - ~~2.1. The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be insulated to be not less than equivalent to the insulation requirement of below-grade walls as specified in Table G402.1.3 or G402.1.4.~~
 - ~~2.2. The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be sealed in accordance with Section G402.5.1.1.~~
 - ~~2.3. The doors into the enclosed room or space shall be fully gasketed.~~
 - ~~2.4. Water lines and ducts in the enclosed room or space shall be insulated in accordance with Section C403.~~
 - ~~2.5. Where an air duct supplying combustion air to the enclosed room or space passes through conditioned space, the duct shall be insulated to an *R*-value of not less than *R*-8.~~

~~Exception:~~ Fireplaces and stoves complying with Sections 901 through 905 of the International Mechanical Code, and Section 2111.14 of the International Building Code.

Reason: The language in the IECC R402.5.3 is deleted in its entirety with no replacement language. Many of the appliances installed today due to Federal Energy Efficiency requirements and customer demands, are direct vent appliances with both intake and exhaust pipes continuous to the outside as listed in exception #1. The concern of this original code change is that the colder air that is installed as combustion air needs to be tempered or conditioned to the temperature of the rest of the building. The thought is that this will save money by not having to warm this colder air once it enters the building. There are advantages to having this open combustion air duct, in the area of the mechanicals in case any of the mechanical combustion appliances need additional air for proper combustion, this opening will supply it. This is a simple safety issue to make combustion air available. Remember, the code is not allowed to create a life safety issue. However the fallacy is in the thought process that this open duct is constantly bringing in cooler or warmer air into the building (depending on the season of the year and your climate zone.) This does not happen. There are some very simple and successful ways to prevent air from entering the building when it's not needed for combustion. With a 90 degree bend in the duct (the most common way) or placing the end of the duct in a pail or container etc. This can be done without the added costs of building walls around the mechanical room that meet the same requirements of the exterior walls of the home including air leakage, and R-values and U factors of the wall system. The average cost of framing a 10 foot wall is between \$150 and \$360 for labor and material, depending on location of the country you are building in. Add to that cost an additional \$50 to \$75 for insulation and another \$100 to \$150 for air sealing and the costs add up very fast. These costs don't even include the average exterior type of door that is required to be gasketed and sealed. Add another \$250 to \$300 not including Labor. And an additional \$50 to \$75 for the hardware, frame and door knobs. So where are the savings for meeting this code change? The fact is that the additional costs to do this are between \$500.00 on the very low end, and \$900 or more, on the higher end. This makes no sense. This code section is trying to solve a problem that does not exist. Especially if the building meets the air tightness requirements of the code already. Also the temperature on both sides of this very expensive wall system is basically the same temperature, why the need for insulation then? Building Physics will dictate that air needs a pressure differential, and a hole, to move air through these walls. Without both a pressure differential and a hole, air will not move. There will not be walls that are separating outside unconditioned air from interior conditioned air, and there will be essentially very little, or no pressure difference from one side of these walls to the other side because there is not going to be a Delta T (Temperature difference). Both sides will be conditioned space. With the cost of housing growing so fast in our country today let's not keep code changes in the code that cost a lot of money, for no return on the investment (ROI)

Cost Impact: The code change proposal will decrease the cost of construction

The cost factor of doing all this work to isolate the room if and when a passive combustion air is brought into the space costs so much more than the language of the code will ever save in the first place.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Encouraged the proponent to bring it back and clarify application for closed combustion appliances (Vote: 15-0).

Assembly Action:

None

CE104-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests As Submitted

Commenter's Reason: The proponent's reasons for deleting the current language is correct and sufficient, especially since the current language is justified based upon life safety, not energy, issues. Life safety of equipment should be taken up in the appropriate ICC codes (e.g., the IFGC for gas-fired equipment).

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proponent's justification for decreased cost of construction is correct.

Public Comment# 2154

CE106-19

IECC: C402.5.9(New), C402.5.9.1(New), C403.1.3(New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Add new text as follows:

C402.5.9 Operable openings interlocking. (Mandatory) Occupancies that utilize an operable opening larger than 40 square feet shall have the openings interlocked with the heating and cooling system to raise the cooling setpoint to 80 degrees or heating to 70 degrees when the operable opening is open in the exterior wall of the building.

Exceptions:

1. Food cooking and prep areas that contain equipment that contributes to the mechanical load calculations of a restaurant type occupancy that are zoned separately.
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
3. The first entrance doors where located in the exterior wall and are part of a vestibule system.

C402.5.9.1 Operable controls (Mandatory) Controls shall comply with Section C403.13.

C403.13 Operable opening interlocking controls. (Mandatory) The heating and cooling systems shall have controls that will interlock these mechanical systems to the set temperatures of 80 degrees for cooling and 70 degrees for heating when the conditions of Section C402.5.9 exist. The controls shall configure to shut off the systems entirely when the outdoor temperatures are below 80 degrees or above 70 degrees.

Reason: It has become a frequent practice for large operable windows, roll up doors, and/or sliding or folding doors to be installed and open to take advantage of cross ventilation or wind to assist with cooling and ventilation of a space. The problem has become that the cooling and heating systems for these spaces are still running, which does not assist with the energy efficiency of a building or space. The intent of this proposal is to address this common practice with a practical approach that utilizes similar concepts in other standards and other jurisdictional amendments without "banning" this practice.

The exceptions are needed to address very specific situations this requirement would hinder the function of the space. When preparing food often the equipment utilized is going to increase the need for mechanical cooling, and it is not the intent to cause any discomfort. The exceptions allow for the food prep areas to still utilize the mechanical cooling system. The second exception acknowledges that many warehouses will utilize natural ventilation, and these doors are often opened for this reason. The third exception is to address when the entrance door is opened for people who are coming and going of the space.

The controls for these systems would not need to be on when the outdoor temperatures have reached the set temperatures.

Cost Impact: The code change proposal will increase the cost of construction

While this requirement will have an increase of cost on the front end it should decrease the operation cost post construction.

CE106-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on proponent's request for disapproval to work on corrections (Vote: 15-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE106-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C402.5.9 (New), C402.5.9.1 (New), C403.13 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.5.9 Operable openings interlocking. (Mandatory) ~~Where occupancies that utilize an operable opening s to the outdoors that are larger than 40 square feet in area shall have the~~ such openings shall be interlocked with the heating and cooling system so as to raise the cooling set point to 90 80 degrees or and lower the heating set point to 55 70 degrees when ever the operable opening is open in the exterior wall ~~The change in heating and cooling setpoints shall occur within 10 minute of opening the operable opening.~~

Exceptions:

1. Separately zoned areas associated with the preparation of food that Food cooking and prep areas that contains appliances equipment that contributes to the HVAC mechanical load s calculations of a restaurant type or similar type of occupancy that are zoned separately.
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
3. The first entrance doors where located in the exterior wall and are part of a vestibule system.

C402.5.9.1 Operable controls (Mandatory) Controls shall comply with Section C403.13.

C403.13 Operable opening interlocking controls. (Mandatory) The heating and cooling systems shall have controls that will interlock these mechanical systems to the set temperatures of 90 80 degrees for cooling and 55 70 degrees for heating when the conditions of Section C402.5.9 exist. The controls shall configure to shut off the systems entirely when the outdoor temperatures are below 90 80 degrees or above 55 70 degrees.

Committer's Reason: The intent of this public comment is to address and correct some values that were entered incorrectly with the original proposal. It also incorporates suggestions from the committee to add a time frame associated for when this would be activated. It has become common practice for restaurants and bars to have large operable openings, such as windows, or sliding /folding doors, or roll up/ overhead doors that are left over for a significant amount of time for either ambiance or to utilize cross ventilation. With the use of these openings the mechanical heating and cooling systems are still functioning as if these openings are not open, and not how they had been designed for. So much time and effort has been made to ensure that these commercial buildings to be energy efficient by having a good thermal envelope with efficient mechanical equipment sized to the building heating and cooling loads, that by leaving these windows and doors open it negates these efforts.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This public comment only adjusts control thresholds and adds an elapsed-time-to-disable-mechanical-system function, both of which is a matter of purchasing the appropriate control. The appropriate control shouldn't cost any more. The original proposal's cost increase is for adding the controls, sensors and wiring to facilitate the control methodology.

Public Comment# 1416

CE108-19

IECC: C202, C202(New), C403.1, C403.1.2 (New), TABLE C403.1.2(1) (New), TABLE C403.1.2(2)(New), TABLE C403.3.2(9), C405.1, TABLE C405.3.2(2), Chapter 6CE (New)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, Energy 350, representing Energy 350 (noneil@energy350.com)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Revise as follows:

COMPUTER ROOM. A room whose primary function is to house equipment for the processing and storage of electronic data ~~and that which has a design electronic data total ITE equipment power density of less than or equal to 20 watts per square foot (20 watts per 0.092 m²) of conditioned floor-area or a connected design electronic data total ITE equipment load of less than or equal to 10 kW.~~

Add new definition as follows:

DATA CENTER. A room, or series of rooms that share data center systems, whose primary function is to house equipment for the processing and storage of electronic data and which has a design total ITE equipment power density exceeding 20 watts per square foot of conditioned area and a total design ITE equipment load greater than 10 kW.

DATA CENTER SYSTEMS. HVAC systems and equipment, or portions thereof used to provide cooling or ventilation in a data center.

INFORMATION TECHNOLOGY EQUIPMENT (ITE) ITE includes computers, data storage devices, servers, and network/communication equipment.

Revise as follows:

C403.1 General. Mechanical systems and equipment serving the building heating, cooling, ventilating or refrigerating needs shall comply with this section.

Exception: Data center systems are exempt from the requirements of Sections C403.4 and C403.5.

Add new text as follows:

C403.1.2 Data Centers Data center systems shall comply with Sections 6 and 8 of ASHRAE 90.4 with the following changes:

1. Replace design MLC values in the ASHRAE 90.4 specified in Table 6.2.1.1 with the values in Table C403.1.2(1) as applicable in each climate zone.
2. Replace annualized MLC values in the ASHREA 90.4 specified in Table 6.2.1.2 with the values in Table C403.1.2(2) as applicable in each climate zone.

C403.1.2(1)

Maximum Design Mechanical Load Component (Design MLC)

Climate Zones as Listed in ASHRAE Standard 169	Design MLC at 100% and at 50% ITE Load
0A	0.24
0B	0.26
1A	0.23
2A	0.24
3A	0.23
4A	0.23
5A	0.22
6A	0.22
1B	0.28
2B	0.27
3B	0.26
4B	0.23
5B	0.23
6B	0.21
3C	0.19
4C	0.21
5C	0.19
7	0.20
8	0.19

C403.1.2(2)

Maximum Annualized Mechanical Load Component (Annualized MLC)

Climate Zones as Listed in ASHRAE Standard 169	HVAC Maximum Annualized MLC at 100% and at 50% ITE Load
<u>0A</u>	<u>0.19</u>
<u>0B</u>	<u>0.20</u>
<u>1A</u>	<u>0.18</u>
<u>2A</u>	<u>0.19</u>
<u>3A</u>	<u>0.18</u>
<u>4A</u>	<u>0.17</u>
<u>5A</u>	<u>0.17</u>
<u>6A</u>	<u>0.17</u>
<u>1B</u>	<u>0.16</u>
<u>2B</u>	<u>0.18</u>
<u>3B</u>	<u>0.18</u>
<u>4B</u>	<u>0.18</u>
<u>5B</u>	<u>0.16</u>
<u>6B</u>	<u>0.17</u>
<u>3C</u>	<u>0.16</u>
<u>4C</u>	<u>0.16</u>
<u>5C</u>	<u>0.16</u>
<u>Z</u>	<u>0.16</u>
<u>8</u>	<u>0.16</u>

Revise as follows:

TABLE C403.3.2(9)
MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS AND DATA CENTERS

EQUIPMENT TYPE	NET SENSIBLE COOLING CAPACITY ^a	MINIMUM SCOP-127 ^b EFFICIENCY DOWNFLOW UNITS / UPFLOW UNITS	TEST PROCEDURE
Air conditioners, air cooled	< 65,000 Btu/h	2.20 / 2.09	ANSI/ASHRAE 127
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥ 240,000 Btu/h	1.90 / 1.79	
Air conditioners, water cooled	< 65,000 Btu/h	2.60 / 2.49	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.50 / 2.39	
	≥ 240,000 Btu/h	2.40 / 2.29	
Air conditioners, water cooled with fluid economizer	< 65,000 Btu/h	2.55 / 2.44	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.45 / 2.34	
	≥ 240,000 Btu/h	2.35 / 2.24	
Air conditioners, glycol cooled (rated at 40% propylene glycol)	< 65,000 Btu/h	2.50 / 2.39	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.15 / 2.04	
	≥ 240,000 Btu/h	2.10 / 1.99	
Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer	< 65,000 Btu/h	2.45 / 2.34	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥ 240,000 Btu/h	2.05 / 1.94	

For SI: 1 British thermal unit per hour = 0.2931 W.

- a. Net sensible cooling capacity: the total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power).
- b. Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.

C405.1 General (Mandatory). This section covers lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption.

Dwelling units within multifamily buildings shall comply with Section R404.1. All other dwelling units shall comply with Section R404.1, or with Sections C405.2.4 and C405.3. Sleeping units shall comply with Section C405.2.4, and with Section R404.1 or C405.3. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2. Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems shall comply with Section 8 of ASHRAE 90.4 in addition to this code.

TABLE C405.3.2(2)
INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE TYPES ^a	LPD (watts/sq.ft)
Atrium	
Less than 40 feet in height	0.03 per foot in total height
Greater than 40 feet in height	0.40 + 0.02 per foot in total height
Audience seating area	
In an auditorium	0.63
In a convention center	0.82
In a gymnasium	0.65
In a motion picture theater	1.14
In a penitentiary	0.28
In a performing arts theater	2.03
In a religious building	1.53
In a sports arena	0.43
Otherwise	0.43
Banking activity area	0.86
Breakroom (See Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	1.34
Otherwise	0.96
Computer room, <u>Data Center</u>	1.33
Conference/meeting/multipurpose room	1.07
Copy/print room	0.56
Corridor	
In a facility for the visually impaired (and not used primarily by the staff) ^b	0.92
In a hospital	0.92
In a manufacturing facility	0.29
Otherwise	0.66
Courtroom	1.39
Dining area	
In bar/lounge or leisure dining	0.93
In cafeteria or fast food dining	0.63
In a facility for the visually impaired (and not used primarily by the staff) ^b	2.00
In family dining	0.71
In a penitentiary	0.96
Otherwise	0.63
Electrical/mechanical room	0.43
Emergency vehicle garage	0.41
Food preparation area	1.06
Guestroom ^{c, d}	0.77
Laboratory	
In or as a classroom	1.20
Otherwise	1.45
Laundry/washing area	0.43
Loading dock, interior	0.58
Lobby	

For an elevator	0.68
In a facility for the visually impaired (and not used primarily by the staff) ^b	2.03
In a hotel	1.06
In a motion picture theater	0.45
In a performing arts theater	1.70
Otherwise	1.0
Locker room	0.48
Lounge/breakroom	
In a healthcare facility	0.78
Otherwise	0.62
Office	
Enclosed	0.93
Open plan	0.81
Parking area, interior	0.14
Pharmacy area	1.34
Restroom	
In a facility for the visually impaired (and not used primarily by the staff) ^b	0.96
Otherwise	0.85
Sales area	1.22
Seating area, general	0.42
Stairway (see Space containing stairway)	
Stairwell	0.58
Storage room	0.46
Vehicular maintenance area	0.56
Workshop	1.14
BUILDING TYPE SPECIFIC SPACE TYPES ^a	LPD (watts/sq.ft)
Automotive (see Vehicular maintenance area)	
Convention Center—exhibit space	0.88
Dormitory—living quarters ^{c, d}	0.54
Facility for the visually impaired ^b	
In a chapel (and not used primarily by the staff)	1.06
In a recreation room (and not used primarily by the staff)	1.80
Fire Station—sleeping quarters ^c	0.20
Gymnasium/fitness center	
In an exercise area	0.50
In a playing area	0.82
Healthcare facility	
In an exam/treatment room	1.68
In an imaging room	1.06
In a medical supply room	0.54
In a nursery	1.00
In a nurse's station	0.81
In an operating room	2.17
In a patient room ^c	0.62
In a physical therapy room	0.84
In a recovery room	1.03
Library	

In a reading area	0.82
In the stacks	1.20
Manufacturing facility	
In a detailed manufacturing area	0.93
In an equipment room	0.65
In an extra-high-bay area (greater than 50' floor-to-ceiling height)	1.05
In a high-bay area (25-50' floor-to-ceiling height)	0.75
In a low-bay area (less than 25' floor-to-ceiling height)	0.96
Museum	
In a general exhibition area	1.05
In a restoration room	0.85
Performing arts theater—dressing room	0.36
Post office—sorting area	0.68
Religious buildings	
In a fellowship hall	0.55
In a worship/pulpit/choir area	1.53
Retail facilities	
In a dressing/fitting room	0.50
In a mall concourse	0.90
Sports arena—playing area	
For a Class I facility ^e	2.47
For a Class II facility ^f	1.96
For a Class III facility ^g	1.70
For a Class IV facility ^h	1.13
Transportation facility	
In a baggage/carousel area	0.45
In an airport concourse	0.31
At a terminal ticket counter	0.62
Warehouse—storage area	
For medium to bulky, palletized items	0.35
For smaller, hand-carried items	0.69

- a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
- b. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.
- c. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.
- d. Where dwelling units are excluded from lighting power calculations by application of Section R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.
- e. Class I facilities consist of professional facilities; and semiprofessional, collegiate, or club facilities with seating for 5,000 or more spectators.
- f. Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators; club facilities with seating for between 2,000 and 5,000 spectators; and amateur league and high-school facilities with seating for more than 2,000 spectators.
- g. Class III facilities consist of club, amateur league and high-school facilities with seating for 2,000 or fewer spectators.
- h. Class IV facilities consist of elementary school and recreational facilities; and amateur league and high-school facilities without provision for spectators.

Add new standard(s) as follows:

90.4-2016: Energy Standard for Data Centers

Reason: Data centers have long had difficulty meeting all prescriptive code requirements and are additionally discouraged from pursuing more efficient alternatives with useful waste heat. Instead of current prescriptive code language (emphasizing component performance ratings and cooler-weather economization) this proposal seeks to require large sophisticated data center projects to meet a performance-based ASHRAE Standard allowing attractive system-wide tradeoffs for efficiency and explicit credit for useful heat recovery. While data centers pursuing this path may experience energy savings, this proposal seeks to instill a performance-based approach to encourage more efficient design overall using a methodology that better suits this unique building type.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. We do not anticipate any significant financial impacts to be incurred due to this change.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.4-2016, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.4-2016, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

CE108-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

TABLE C403.1.2(1)

Maximum Design Mechanical Load Component (Design MLC)

Climate Zones as Listed in ASHRAE Standard 169	Design MLC at 100% and at 50% ITE Load
0A	0.24
0B	0.26
1A	0.23
2A	0.24
3A	0.23
4A	0.23
5A	0.22
6A	0.22
1B	0.28
2B	0.27
3B	0.26
4B	0.23
5B	0.23
6B	0.21
3C	0.19
4C	0.21
5C	0.19
7	0.20
8	0.19

Maximum Annualized Mechanical Load Component (Annualized MLC)

Climate Zones as Listed in ASHRAE Standard 169	HVAC Maximum Annualized MLC at 100% and at 50% ITE Load
0A	0.19
0B	0.20
1A	0.18
2A	0.19
3A	0.18
4A	0.17
5A	0.17
6A	0.17
1B	0.16
2B	0.18
3B	0.18
4B	0.18
5B	0.16
6B	0.17
3C	0.16
4C	0.16
5C	0.16
7	0.16
8	0.16

Committee Reason: The proposal provides clear requirements for managing energy use in Data Centers. It needs a public comment to align the definition with ASHRAE 90.4 Testimony indicated their intent was mandatory as applicable. The modification removed a reference standard that is not in the IECC (Vote: 12-3).

Assembly Action:

None

CE108-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: There are many technical problems with the proposal as submitted:

- It refers to an older version of 90.4. The 2019 version is scheduled to be published by October, 2019.
- The proposed definition of *data center systems* is significantly different from the definition in the 2016 version of 90.4.
- It takes only a portion of a Standard (90.4), but not other key portions of the Standard.
- It refers to using Chapters 6 and 8 of the Standard, but there are numerous technical terms in both chapters that are not defined in this proposal.
- The efficiency values shown for lighting power density and computer room air conditioners are not consistent with the latest version of ASHRAE

90.1 (where the values are updated).

-The MLC and ELC values shown in the proposal will be less stringent than the values shown in the 2019 version of ASHRAE Standard 90.4.

-There is a better solution available. CE-43 allows the use of the whole standard 90.4, using the most recent version.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will not change the current code.

Public Comment# 1290

CE111-19

IECC: C202, (New), C403.2, C403.2.3(New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new text as follows:

FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM A software platform that utilizes building analytic algorithms to convert data provided by sensors and devices to automatically identify faults in building systems and provide a prioritized list of actionable resolutions to those faults based on cost or energy avoidance, comfort and maintenance impact.

Revise as follows:

C403.2 System design (Mandatory). Mechanical systems shall be designed to comply with Sections C403.2.1 ~~and C403.2.2 through C403.2.3.~~ Where elements of a building's mechanical systems are addressed in Sections C403.3 through C403.12, such elements shall comply with the applicable provisions of those sections.

Add new text as follows:

C403.2.3 Fault Detection and Diagnostics (Mandatory) New buildings with a gross conditioned floor area of 100,000 square feet (9290 square meters) or larger shall include a fault detection and diagnostics (FDD) system to monitor the HVAC system's performance and automatically identify faults. The FDD system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system's performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;
4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Reason: Energy efficiency of a new building's HVAC system will degrade over time caused by poorly maintained, failing and improperly controlled equipment. The proposed FDD requirement will reduce that degradation by detecting HVAC system faults and notifying building operators so that actions may be taken to reduce energy consumption of the building. Additionally, FDD systems are being utilized to drive operational efficiency, make better use of maintenance personnel, and resolve comfort issues.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change proposal "will" increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link <https://ecobuilding.schneider-electric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25>: Setup/install cost - \$23,190, Annual maintenance cost - \$35,407, and Annual savings - \$286,000.

CE111-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C403.2.3 Fault Detection and Diagnostics (Mandatory). New buildings with ~~a~~ an HVAC system serving a gross conditioned floor area of 100,000 square feet (9290 square meters) or larger shall include a fault detection and diagnostics (FDD) system to monitor the HVAC system's performance and automatically identify faults. The FDD system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system's performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;

4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Exception: R1 and R-2 occupancies.

Committee Reason: This is on-going commissioning, a good means of cost effective energy savings. Inspecting for it is similar to metering systems. Security issues are addressed if it can be operated not in the cloud. The modification corrects the pointer from building size to HVAC size and opponent's comments (Vote: 15-0).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE111-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: While this proposal sounds like a good idea, it has huge cost and security implications. This proposal also has no enforcement arm to fix anything the system finds is not performing as the software says it should be.

There are many sophisticated owners who already have similar systems in place that monitor system performance, they may not monitor to the level the proponent is requesting, or make a recommendation, but the owner is still aware of how their systems are functioning. Requiring an additional system which can be breached is a security concern, this would have to be a stand alone system in many buildings. Who decides what the fix will be if a fault occurs, and does it even need to be corrected?

The cost is greater than what is in the cost impact study, someone needs to say what needs to be fixed, establish a cost, establish a priority and decide which exact items will be monitored. The annual maintenance cost of \$35k is extremely high and the savings of \$265k is not even fathomable. This sounds like a proprietary system that provides no benefit other than giving some information that can easily be ignored.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1565

CE112-19

IECC@: TABLE C403.3.2(5)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE C403.3.2(5)
MINIMUM EFFICIENCY REQUIREMENTS: GAS- AND OIL-FIRED BOILERS

Portions of table not shown remain unchanged.

EQUIPMENT TYPE^a	SUBCATEGORY OR RATING CONDITION	SIZE CATEGORY (INPUT)	MINIMUM EFFICIENCY^{d, e}	TEST PROCEDURE
Boilers, steam	Gas-fired	< 300,000 Btu/h ^f	80% AFUE	10 CFR Part 430
	Gas-fired- all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	79% E _t	10 CFR Part 431
		> 2,500,000 Btu/h ^a	79% E _t	
	Gas-fired-natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	77% E _t <u>79% E_t as of</u> <u>March 2,2020</u>	
		> 2,500,000 Btu/h ^a	77% E _t <u>79% E_t as of Mach</u> <u>2,2020</u>	
		< 300,000 Btu/h	82% AFUE	
	Oil-fired ^c	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	81% E _t	10 CFR Part 431
		> 2,500,000 Btu/h ^a	81% E _t	

For SI: 1 British thermal unit per hour = 0.2931 W.

- a. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.
- b. Maximum capacity – minimum and maximum ratings as provided for and allowed by the unit’s controls.
- c. Includes oil-fired (residual).
- d. E_c = Combustion efficiency (100 percent less flue losses).
- e. E_t = Thermal efficiency. See referenced standard for detailed information.
- f. Boilers shall not be equipped with a constant-burning ignition pilot.
- g. A boiler not equipped with a tankless domestic water heating coil shall be equipped with an automatic means for adjusting the temperature of the water such that an incremental change in inferred heat load produces a corresponding incremental change in the temperature of the water supplied.

Reason: This will align the IECC with the required minimum efficiency values shown in ASHRAE 90.1-2016 (and 2013, 2010, and 2007) Table 6.8.1-6, "Gas and Oil Fired *Boilers* - Minimum *Efficiency* Requirements".

These values were agreed to on a consensus basis by the ASHRAE Mechanical SubCommittee, the ASHRAE 90.1 Full Committee, and then went out for public review before being published.

Cost Impact: The code change proposal will increase the cost of construction
 There will be an increase in cost to install higher efficiency equipment.

CE112-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on proponent's request for disapproval and prior action on CE113 (Vote: 14-1).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests As Submitted

Commenter's Reason: The proponent is correct that the IECC needs to reflect the minimum efficiencies promulgated by ASHRAE 90.1 on equipment since failing to do so, the IECC efficiencies would be preempted under federal law.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The proponent's comment on cost of construction is sufficient.

Public Comment# 2150

CE113-19

IECC@: C403.3.2, TABLE C403.3.2(1), TABLE C403.3.2(2), TABLE C403.3.2(3), TABLE C403.3.2(4), TABLE C403.3.2(5), TABLE C403.3.2(6), TABLE C403.3.2(7), TABLE C403.3.2(8), TABLE C403.3.2(9), TABLE C403.3.2(10), C403.3.2.1, C403.3.2.2, C403.5.5, C403.9, C406.2, TABLE C407.5.1(1), C408.2.3.1

Proposed Change as Submitted

Proponents: Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

2018 International Energy Conservation Code

Revise as follows:

C403.3.2 HVAC equipment performance requirements (Mandatory). Equipment shall meet the minimum efficiency requirements of Tables ~~C403.3.2(1) through C403.3.2(9)~~ 6.8.1-1 through 6.8.1-19 of ASHRAE Standard 90.1 when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table ~~C403.3.2(10)~~ 6.8.1-8 of ASHRAE Standard 90.1. The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units - Minimum Efficiency Requirements

Table 6.8.1-2 Electrically Operated Air Cooled Unitary and Heat Pumps - Minimum Efficiency Requirements

Table 6.8.1-3 Water Chilling Packages - Minimum Efficiency Requirements

Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements

Table 6.8.1-6 Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements

Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements

Table 6.8.1-8 Heat Transfer Equipment—Minimum Efficiency Requirements

Table 6.8.1-9 Electrically Operated Variable-Refrigerant-Flow Air Conditioners—Minimum Efficiency Requirements

Table 6.8.1-10 Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps— Minimum Efficiency Requirements[if supportFields]>
FILENAME

Table 6.8.1-11 Floor Mounted Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements

Table 6.8.1-13 Commercial Refrigerators, Freezers and Refrigeration—Minimum Efficiency Requirements

Table 6.8.1-14 Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements

Table 6.8.1-15 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements

Table 6.8.1-16 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements

Table 6.8.1-17 Electrically Operated Water Source Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-18 Heat Pump and Heat Reclaim Chiller Packages – Minimum Efficiency Requirements

Table 6.8.1-19 Ceiling Mounted Computer Room Air Conditioners—Minimum Efficiency Requirements

Delete without substitution:

TABLE C403.3.2(1)

MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE ^a	
Air conditioners, air cooled	< 65,000 Btu/h ^b	All	Split System	13.0 SEER	AHRI 210/240	
			Single Package	14.0 SEER		
Through-the-wall (air cooled)	≤ 30,000 Btu/h ^b	All	Split system	12.0 SEER		
			Single Package	12.0 SEER		
Small duct high-velocity (air cooled)	< 65,000 Btu/h ^b	All	Split System	11.0 SEER		
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.2 EER/12.8 IEER		AHRI 340/360
		All other	Split System and Single Package	11.0 EER/12.6 IEER		
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER/12.4 IEER		
		All other	Split System and Single Package	10.8 EER/12.2 IEER		
	≥ 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.0 EER/11.6 IEER		
		All other	Split System and Single Package	9.8 EER/11.4 IEER		
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.7 EER/11.2 IEER		
		All other	Split System and Single Package	9.5 EER/11.0 IEER		
	Air conditioners, water cooled	< 65,000 Btu/h ^b	All	Split System and Single Package	12.1 EER/12.3 IEER	AHRI 210/240
		≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	12.1 EER/13.9 IEER	AHRI 340/360
			All other	Split System and Single Package	11.9 EER/13.7 IEER	
		≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	12.5 EER/13.9 IEER	
All other			Split System and Single Package	12.3 EER/13.7 IEER		
≥ 240,000 Btu/h and < 760,000 Btu/h		Electric Resistance (or None)	Split System and Single Package	12.4 EER/13.6 IEER		
		All other	Split System and Single Package	12.2 EER/13.4 IEER		
≥ 760,000 Btu/h		Electric Resistance (or None)	Split System and Single Package	12.2 EER/13.5 IEER		
		All other	Split System and Single Package	12.0 EER/13.3 IEER		
Air conditioners, water cooled		< 65,000 Btu/h ^b	All	Split System and Single Package	12.1 EER/12.3 IEER	AHRI 210/240
		≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	12.1 EER/12.3 IEER	
			All other	Split System and Single Package	11.9 EER/12.1 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	12.0 EER/12.2 IEER		
All other		Split System and Single Package	11.8 EER/12.0 IEER			

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air conditioners, evaporatively cooled	$\geq 135,000$ Btu/h and $< 240,000$ Btu/h	All other	Split System and Single Package	11.8 EER/12.0 IEER	AHRI 340/360
	$\geq 240,000$ Btu/h and $< 760,000$ Btu/h	Electric Resistance (or None)	Split System and Single Package	11.9 EER/12.1 IEER	
		All other	Split System and Single Package	11.7 EER/11.9 IEER	
	$\geq 760,000$ Btu/h	Electric Resistance (or None)	Split System and Single Package	11.7 EER/11.9 IEER	
		All other	Split System and Single Package	11.5 EER/11.7 IEER	
Gondensing units, air cooled	$\geq 135,000$ Btu/h	—	—	10.5 EER/11.8 IEER	AHRI 365
Gondensing units, water cooled	$\geq 135,000$ Btu/h	—	—	13.5 EER/14.0 IEER	
Gondensing units, evaporatively cooled	$\geq 135,000$ Btu/h	—	—	13.5 EER/14.0 IEER	

For SI: 1 British thermal unit per hour = 0.2931 W.

- a. Chapter 6 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.
- b. Single phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE C403.3.2(2)
MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE ^a
Air cooled (cooling mode)	< 65,000 Btu/h ^b	All	Split System	14.0 SEER	AHRI 210/240
			Single Package	14.0 SEER	
Through-the-wall, air cooled	≤ 30,000 Btu/h ^b	All	Split System	12.0 SEER	
			Single Package	12.0 SEER	
Single-duct high-velocity air cooled	< 65,000 Btu/h ^b	All	Split System	11.0 SEER	
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 12.0 IEER	
		All other	Split System and Single Package	10.8 EER 11.8 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.6 EER 11.6 IEER	
		All other	Split System and Single Package	10.4 EER 11.4 IEER	
	≥ 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER 10.6 IEER	
		All other	Split System and Single Package	9.3 EER 9.4 IEER	
Water to Air: Water Loop (cooling mode)	< 17,000 Btu/h	All	86°F entering water	12.2 EER	ISO 13256-1
	≥ 17,000 Btu/h and < 65,000 Btu/h	All	86°F entering water	13.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	All	86°F entering water	13.0 EER	
Water to Air: Ground Water (cooling mode)	< 135,000 Btu/h	All	59°F entering water	18.0 EER	ISO 13256-1
Brine to Air: Ground Loop (cooling mode)	< 135,000 Btu/h	All	77°F entering water	14.1 EER	ISO 13256-1
Water to Water: Water Loop (cooling mode)	< 135,000 Btu/h	All	86°F entering water	10.6 EER	ISO 13256-2
Water to Water: Ground Water (cooling mode)	< 135,000 Btu/h	All	59°F entering water	16.3 EER	
Brine to Water: Ground Loop (cooling mode)	< 135,000 Btu/h	All	77°F entering fluid	12.1 EER	
Air cooled (heating mode)	< 65,000 Btu/h ^b	—	Split System	8.2 HSPF	
Through-the-wall, (air cooled, heating mode)	≤ 30,000 Btu/h ^b (cooling capacity)	—	Single Package	8.0 HSPF	
			Split System	7.4 HSPF	
Small-duct high-velocity (air cooled, heating mode)	< 65,000 Btu/h ^b	—	Single Package	7.4 HSPF	
Air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	—	47°F db/43°F wb outdoor air	3.3 COP	AHRI 340/360
			17°F db/15°F wb outdoor air	2.25 COP	
			47°F db/43°F wb outdoor air	3.2 COP	

EQUIPMENT TYPE	≥135,000 Btu/h (cooling capacity) SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
			17°F db/15°F wb outdoor air	2.05-GOP	
Water to Air: Water Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	68°F entering water	4.3-GOP	ISO-13256-1
Water to Air: Ground Water (heating mode)	<135,000 Btu/h (cooling capacity)	—	50°F entering water	3.7-GOP	
Brine to Air: Ground Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	32°F entering fluid	3.2-GOP	
Water to Water: Water Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	68°F entering water	3.7-GOP	ISO-13256-2
Water to Water: Ground Water (heating mode)	<135,000 Btu/h (cooling capacity)	—	50°F entering water	3.1-GOP	
Brine to Water: Ground Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	32°F entering fluid	2.5-GOP	

For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8.

- a. Chapter 6 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.
- b. Single phase, air-cooled heat pumps less than 65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.

TABLE G403.3.2(3)

MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE ^a
PTAC (cooling mode) new construction	All Capacities	95°F db outdoor air	14.0 – (0.300 × Cap/1000) EER	AHRI 310/380
PTAC (cooling mode) replacements ^b	All Capacities	95°F db outdoor air	10.9 – (0.213 × Cap/1000) EER	
PTHP (cooling mode) new construction	All Capacities	95°F db outdoor air	14.0 – (0.300 × Cap/1000) EER	
PTHP (cooling mode) replacements ^b	All Capacities	95°F db outdoor air	10.8 – (0.213 × Cap/1000) EER	
PTHP (heating mode) new construction	All Capacities	—	3.2 – (0.026 × Cap/1000) COP	
PTHP (heating mode) replacements ^b	All Capacities	—	2.9 – (0.026 × Cap/1000) COP	
SPVAC (cooling mode)	< 65,000 Btu/h	95°F db/ 75°F wb outdoor air	9.0 EER	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/ 75°F wb outdoor air	8.6 EER	
SPVHP (cooling mode)	< 65,000 Btu/h	95°F db/ 75°F wb outdoor air	9.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/ 75°F wb outdoor air	8.6 EER	
SPVHP (heating mode)	< 65,000 Btu/h	47°F db/ 43°F wb outdoor air	3.0 COP	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	47°F db/ 43°F wb outdoor air	3.0 COP	
	≥ 135,000 Btu/h and < 240,000 Btu/h	47°F db/ 75°F wb outdoor air	2.9 COP	
Room air conditioners, with louvered sides	< 6,000 Btu/h	—	11.0 GEER	ANSI/AHAM RAC-1
	≥ 6,000 Btu/h and < 8,000 Btu/h	—	11.0 GEER	
	≥ 8,000 Btu/h and < 14,000 Btu/h	—	10.9 GEER	
	≥ 14,000 Btu/h and < 20,000 Btu/h	—	10.7 GEER	
	≥ 20,000 Btu/h and ≤ 25,000 Btu/h	—	9.4 GEER	
	> 25,000 Btu/h	—	9.0 GEER	
Room air conditioners, without louvered sides	< 6,000 Btu/h	—	10.0 GEER	
	≥ 6,000 Btu/h and < 8,000 Btu/h	—	10.0 GEER	
	≥ 8,000 Btu/h and < 11,000 Btu/h	—	9.6 GEER	
	≥ 11,000 Btu/h and < 14,000 Btu/h	—	9.5 GEER	
	≥ 14,000 Btu/h and < 20,000 Btu/h	—	9.3 GEER	

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
	≥ 20,000 Btu/h	—	9.4 CEER	
Room air conditioner heat pumps with louvered sides	< 20,000 Btu/h	—	9.8 CEER	
	≥ 20,000 Btu/h	—	9.3 CEER	
Room air conditioner heat pumps without louvered sides	< 14,000 Btu/h	—	9.3 CEER	
	≥ 14,000 Btu/h	—	8.7 CEER	
Room air conditioner casement only	All capacities	—	9.5 CEER	
Room air conditioner casement slider	All capacities	—	10.4 CEER	

For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8, wb = wet bulb, db = dry bulb.

“Cap” = The rated cooling capacity of the project in Btu/h. Where the unit’s capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. Where the unit’s capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations.

- a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
- b. Replacement unit shall be factory labeled as follows: “MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS.” Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) in height and less than 42 inches (1067 mm) in width.

TABLE G403.3.2(4)

WARM-AIR FURNACES AND COMBINATION WARM-AIR FURNACES/AIR-CONDITIONING UNITS, WARM-AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY ^{d,e}	TEST PROCEDURE ^a
Warm-air furnaces, gas-fired	< 225,000 Btu/h	—	80% AFUE or 80% E_t^b †	DOE-10 CFR Part 430 or ANSI Z21.47
	≥ 225,000 Btu/h	Maximum capacity ^c	80% E_t^f	ANSI Z21.47
Warm-air furnaces, oil-fired	< 225,000 Btu/h	—	83% AFUE or 80% E_t^b †	DOE-10 CFR Part 430 or UL 727
	≥ 225,000 Btu/h	Maximum capacity ^b	81% E_t^g	UL 727
Warm-air duct furnaces, gas-fired	All capacities	Maximum capacity ^b	80% E_e	ANSI Z83.8
Warm-air unit heaters, gas-fired	All capacities	Maximum capacity ^b	80% E_e	ANSI Z83.8
Warm-air unit heaters, oil-fired	All capacities	Maximum capacity ^b	80% E_e	UL 731

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. Minimum and maximum ratings as provided for and allowed by the unit's controls.

c. Combination units not covered by the National Appliance Energy Conservation Act of 1987 (NAECA) (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) shall comply with either rating.

d. E_t = Thermal efficiency. See test procedure for detailed discussion.

e. E_e = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

f. E_e = Combustion efficiency. Units shall also include an IID, have jackets not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

g. E_t = Thermal efficiency. Units shall also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

**TABLE C403.3.2(5)
MINIMUM EFFICIENCY REQUIREMENTS: GAS AND OIL-FIRED BOILERS**

EQUIPMENT TYPE^a	SUBCATEGORY OR RATING CONDITION	SIZE CATEGORY (INPUT)	MINIMUM EFFICIENCY^{d,f,e}	TEST PROCEDURE
Boilers, hot water	Gas-fired	< 300,000 Btu/h ^{f,g}	82% AFUE	10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	80% E_t	10 CFR Part 431
		> 2,500,000 Btu/h ^a	82% E_e	
	Oil-fired ^e	< 300,000 Btu/h ^g	84% AFUE	10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	82% E_t	10 CFR Part 431
		> 2,500,000 Btu/h ^a	84% E_e	
Boilers, steam	Gas-fired	< 300,000 Btu/h ^f	80% AFUE	10 CFR Part 430
	Gas-fired— all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	79% E_t	10 CFR Part 431
		> 2,500,000 Btu/h ^a	79% E_t	
	Gas-fired— natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	77% E_t	
		> 2,500,000 Btu/h ^a	77% E_t	
	Oil-fired ^e	< 300,000 Btu/h	82% AFUE	10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^b	81% E_t	10 CFR Part 431
		> 2,500,000 Btu/h ^a	81% E_t	

For SI: 1 British thermal unit per hour = 0.2931 W.

- a. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.
- b. Maximum capacity — minimum and maximum ratings as provided for and allowed by the unit's controls.
- c. Includes oil-fired (residual).
- d. E_e = Combustion efficiency (100 percent less flue losses).
- e. E_t = Thermal efficiency. See referenced standard for detailed information.
- f. Boilers shall not be equipped with a constant burning ignition pilot.
- g. A boiler not equipped with a tankless domestic water heating coil shall be equipped with an automatic means for adjusting the temperature of the water such that an incremental change in inferred heat load produces a corresponding incremental change in the temperature of the water supplied.

TABLE C403.3.2(6)
MINIMUM EFFICIENCY REQUIREMENTS: CONDENSING UNITS, ELECTRICALLY OPERATED

EQUIPMENT TYPE	SIZE CATEGORY	MINIMUM EFFICIENCY ^b	TEST PROCEDURE ^a
Condensing units, air cooled	≥ 135,000 Btu/h	10.1 EER/11.2 IPLV	AHRI 365
Condensing units, water or evaporatively cooled	≥ 135,000 Btu/h	13.1 EER/13.1 IPLV	

For SI: 1 British thermal unit per hour = 0.2931 W.

- a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
- b. IPLVs are only applicable to equipment with capacity modulation.

TABLE C403.3.2(7)
WATER-CHILLING PACKAGES — EFFICIENCY REQUIREMENTS^{a, b, d}

EQUIPMENT TYPE	SIZE CATEGORY	UNITS	BEFORE 1/1/2015		AS OF 1/1/2015		TEST PROCEDURE ^e
			Path A	Path B	Path A	Path B	
Air-cooled chillers	< 150 Tons	EER (Btu/W)	≥ 9.562 FL	NA ^e	≥ 10.100 FL	≥ 9.700 FL	AHRI 550/590
			≥ 12.500 IPLV		≥ 13.700 IPLV	≥ 15,800 IPLV	
	≥ 150 Tons		≥ 9.562 FL	NA ^e	≥ 10.100 FL	≥ 9.700 FL	
			≥ 12.500 IPLV		≥ 14.000 IPLV	≥ 16.100 IPLV	
Air-cooled without condenser, electrically-operated	All capacities	EER(Btu/W)	Air-cooled chillers without condenser shall be rated with matching condensers and complying with air-cooled chiller efficiency requirements.				
Water-cooled, electrically operated positive displacement	< 75 Tons	kW/ton	≤ 0.780 FL	≤ 0.800 FL	≤ 0.750 FL	≤ 0.780 FL	
	≥ 75 tons and < 150 tons		≤ 0.630 IPLV	≤ 0.600 IPLV	≤ 0.600 IPLV	≤ 0.500 IPLV	
			≤ 0.775 FL	≤ 0.790 FL	≤ 0.720 FL	≤ 0.750 FL	
	≥ 150 tons and < 300 tons		≤ 0.615 IPLV	≤ 0.586 IPLV	≤ 0.560 IPLV	≤ 0.490 IPLV	
			≥ 0.680 FL	≥ 0.718 FL	≥ 0.660 FL	≥ 0.680 FL	
	≥ 300 tons and < 600 tons		≥ 0.580 IPLV	≥ 0.540 IPLV	≥ 0.540 IPLV	≥ 0.440 IPLV	
			≤ 0.620 FL	≤ 0.630 FL	≤ 0.610 FL	≤ 0.625 FL	
	≥ 600 tons		≤ 0.540 IPLV	≤ 0.490 IPLV	≤ 0.520 IPLV	≤ 0.410 IPLV	
≤ 0.620 FL		≤ 0.630 FL	≤ 0.560 FL	≤ 0.585 FL			
Water-cooled, electrically operated centrifugal	< 150 Tons	kW/ton	≤ 0.634 FL	≤ 0.630 FL	≤ 0.610 FL	≤ 0.695 FL	
	≥ 150 tons and < 300 tons		≤ 0.596 IPLV	≤ 0.450 IPLV	≤ 0.550 IPLV	≤ 0.440 IPLV	
			≤ 0.634 FL	≤ 0.630 FL	≤ 0.610 FL	≤ 0.635 FL	
	≥ 300 tons and < 400 tons		≤ 0.596 IPLV	≤ 0.450 IPLV	≤ 0.550 IPLV	≤ 0.400 IPLV	
			≤ 0.576 FL	≤ 0.600 FL	≤ 0.560 FL	≤ 0.595 FL	
	≥ 400 tons and < 600 tons		≤ 0.540 IPLV	≤ 0.400 IPLV	≤ 0.520 IPLV	≤ 0.390 IPLV	
			≤ 0.576 FL	≤ 0.600 FL	≤ 0.560 FL	≤ 0.585 FL	
	≥ 600 Tons		≤ 0.540 IPLV	≤ 0.400 IPLV	≤ 0.500 IPLV	≤ 0.380 IPLV	
≤ 0.570 FL		≤ 0.590 FL	≤ 0.560 FL	≤ 0.585 FL			
Air-cooled, absorption, single effect	All capacities	GOP	≥ 0.600 FL	NA ^e	≥ 0.600 FL	NA ^e	AHRI 560
Water-cooled absorption, single effect	All capacities	GOP	≥ 0.700 FL	NA ^e	≥ 0.700 FL	NA ^e	
Absorption, double effect, indirect fired	All capacities	GOP	≥ 1.000 FL	NA ^e	≥ 1.000 FL	NA ^e	
			≥ 1.050 IPLV		≥ 1.050 IPLV		
Absorption double effect direct fired	All capacities	GOP	≥ 1.000 FL	NA ^e	≥ 1.000 FL	NA ^e	
			≥ 1.000 IPLV		≥ 1.050 IPLV		

a. The requirements for centrifugal chiller shall be adjusted for nonstandard rating conditions in accordance with Section C403.3.2.1 and are only applicable for the range of conditions listed in Section C403.3.2.1. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.

b. Both the full load and IPLV requirements shall be met or exceeded to comply with this standard. Where there is a Path B, compliance can be with either Path A or Path B for any application.

c. NA means the requirements are not applicable for Path B and only Path A can be used for compliance.

d. FL represents the full load performance requirements and IPLV the part load performance requirements.

**TABLE C403.3.2(8)
MINIMUM EFFICIENCY REQUIREMENTS: HEAT REJECTION EQUIPMENT**

EQUIPMENT TYPE^a	TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITIONⁱ	PERFORMANCE REQUIRED^{b, c, d, f, g, h}	TEST PROCEDURE^{e, f}
Propeller or axial fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥ 40.2 gpm/hp	GTI-ATC-105 and GTI-STD-201-RS
Centrifugal fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥ 20.0 gpm/hp	GTI-ATC-105 and GTI-STD-201-RS
Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥ 16.1 gpm/hp	GTI-ATC-105S and GTI-STD-201-RS
Centrifugal fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥ 7.0 gpm/hp	GTI-ATC-105S and GTI-STD-201-RS
Propeller or axial fan evaporative condensers	All	Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥ 134,000 Btu/h × hp	GTI-ATC-106
Centrifugal fan evaporative condensers	All	Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥ 110,000 Btu/h × hp	GTI-ATC-106
Propeller or axial fan evaporative condensers	All	R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥ 157,000 Btu/h × hp	GTI-ATC-106
Centrifugal fan evaporative condensers	All	R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥ 135,000 Btu/h × hp	GTI-ATC-106
Air-cooled condensers	All	125°F Condensing Temperature 190°F Entering Gas Temperature 15°F subcooling 95°F entering db	≥ 176,000 Btu/h × hp	AHRI-460

For SI: °C = [(°F) - 32]/1.8, L/s = kW = (gpm/hp)/(11.83), COP = (Btu/h - hp)/(2550.7);

db = dry bulb temperature, °F, wb = wet bulb temperature, °F.

- a. The efficiencies and test procedures for both open- and closed-circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of wet and dry heat-exchange sections.
- b. For purposes of this table, open-circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition, divided by the fan nameplate-rated motor power.
- c. For purposes of this table, closed-circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition, divided by the sum of the fan nameplate-rated motor power and the spray pump nameplate-rated motor power.
- d. For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate-rated motor power.
- e. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. The certification requirements do not apply to field-erected cooling towers.
- f. Where a certification program exists for a covered product and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program; or, where a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report.
- g. Cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project-specific accessories or options included in the capacity of the cooling tower.
- h. For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power.
- i. Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A shall meet the minimum efficiency requirements listed in this table with R-507A as the test fluid.

**TABLE C403.3.2(9)
MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS**

EQUIPMENT TYPE	NET SENSIBLE COOLING CAPACITY ^a	MINIMUM SCOP-127 ^b EFFICIENCY DOWNFLOW UNITS / UPFLOW UNITS	TEST PROCEDURE
Air conditioners, air cooled	< 65,000 Btu/h	2.20 / 2.09	ANSI/ASHRAE 127
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥ 240,000 Btu/h	1.90 / 1.79	
Air conditioners, water cooled	< 65,000 Btu/h	2.60 / 2.49	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.50 / 2.39	
	≥ 240,000 Btu/h	2.40 / 2.29	
Air conditioners, water cooled with fluid economizer	< 65,000 Btu/h	2.55 / 2.44	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.45 / 2.34	
	≥ 240,000 Btu/h	2.35 / 2.24	
Air conditioners, glycol cooled (rated at 40% propylene glycol)	< 65,000 Btu/h	2.50 / 2.39	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.15 / 2.04	
	≥ 240,000 Btu/h	2.10 / 1.99	
Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer	< 65,000 Btu/h	2.45 / 2.34	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥ 240,000 Btu/h	2.05 / 1.94	

For SI: 1 British thermal unit per hour = 0.2931 W.

- a. Net sensible cooling capacity: the total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross — latent — Fan Power).
- b. Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.

TABLE C403.3.2(10)
HEAT TRANSFER EQUIPMENT

EQUIPMENT TYPE	SUBCATEGORY	MINIMUM EFFICIENCY	TEST PROCEDURE*
Liquid to liquid heat exchangers	Plate type	NR	AHRI 400

NR = No Requirement.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

C403.3.2.1 Water-cooled centrifugal chilling packages (Mandatory). Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44 °F (7 °C) leaving chilled-water temperature and 2.4 gpm/ton evaporator fluid flow and 85 °F (29 °C) entering condenser water temperature with 3 gpm/ton (0.054 l/s • kW) condenser water flow shall have maximum full-load kW/ton (FL) and part-load ratings requirements adjusted using Equations 4-6 and 4-7.

$$FL_{adj} = FL/K_{adj}$$

(Equation 4-6)

$$PLV_{adj} = IPLV/K_{adj}$$

(Equation 4-7)

where:

$$K_{adj} = A \times B$$

FL = Full-load kW/ton value as specified in ~~Table C403.3.2(7)~~ the tables in Section C403.3.2.

FL_{adj} = Maximum full-load kW/ton rating, adjusted for nonstandard conditions.

$IPLV$ = Value as specified in ~~Table C403.3.2(7)~~ the tables in Section C403.3.2.

PLV_{adj} = Maximum $NPLV$ rating, adjusted for nonstandard conditions.

$$A = 0.00000014592 \times (LIFT)^4 + 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.9302$$

$$B = 0.0015 \times L_{vg}E_{vap} + 0.934$$

$$LIFT = L_{vg}Cond - L_{vg}E_{vap}$$

$L_{vg}Cond$ = Full-load condenser leaving fluid temperature (°F).

$L_{vg}Evap$ = Full-load evaporator leaving temperature (°F).

The FL_{adj} and PLV_{adj} values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. Minimum evaporator leaving temperature: 36 °F.
2. Maximum condenser leaving temperature: 115 °F.
3. 20 °F ≤ LIFT ≤ 80 °F.

C403.3.2.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32 °F (0 °C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115 °F (46 °C) shall meet the requirements of ~~Table C403.3.2(7)~~ the tables in Section C403.3.2, when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.

C403.5.5 Economizer fault detection and diagnostics (Mandatory). Air-cooled unitary direct-expansion units listed in ~~Tables C403.3.2(1) through C403.3.2(3)~~ the tables in Section C403.3.2, and variable refrigerant flow (VRF) units that are equipped with an economizer in accordance with Sections C403.5 through C403.5.4 shall include a fault detection and diagnostics system complying with the following:

1. The following temperature sensors shall be permanently installed to monitor system operation:
 - 1.1. Outside air.
 - 1.2. Supply air.
 - 1.3. Return air.
2. Temperature sensors shall have an accuracy of ±2 °F (1.1 °C) over the range of 40 °F to 80 °F (4 °C to 26.7 °C).
3. Refrigerant pressure sensors, where used, shall have an accuracy of ±3 percent of full scale.
4. The unit controller shall be configured to provide system status by indicating the following:
 - 4.1. Free cooling available.

- 4.2. Economizer enabled.
- 4.3. Compressor enabled.
- 4.4. Heating enabled.
- 4.5. Mixed air low limit cycle active.
- 4.6. The current value of each sensor.
- 5. The unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans and the heating system can be independently tested and verified.
- 6. The unit shall be configured to report faults to a fault management application available for access by day-to-day operating or service personnel, or annunciated locally on zone thermostats.
- 7. The fault detection and diagnostics system shall be configured to detect the following faults:
 - 7.1. Air temperature sensor failure/fault.
 - 7.2. Not economizing when the unit should be economizing.
 - 7.3. Economizing when the unit should not be economizing.
 - 7.4. Damper not modulating.
 - 7.5. Excess outdoor air.

C403.9 Heat rejection equipment. Heat rejection equipment, including air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers and evaporative condensers, shall comply with this section.

Exception: Heat rejection devices where energy usage is included in the equipment efficiency ratings listed in ~~Tables C403.3.2(6) and C403.3.2(7)~~ the tables in Section C403.3.2.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in ~~Tables C403.3.2(1) through C403.3.2(7)~~ the tables in Section C403.3.2 by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) shall be limited to 10 percent of the total building system capacity.

**TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.5.2 for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: Insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: Mass wall where proposed wall is mass; otherwise steel-framed wall	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: Mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: as specified in Table C402.1.4 with insulation layer on interiorside of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Floors, slab-on-grade	Type: Unheated	As proposed
	F-factor: as specified in Table C402.1.4	As proposed
Opaque doors	Type: Swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Vertical fenestration other than opaque doors	Area 1.The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 40 percent of above-grade wall area.	As proposed
	2.40 percent of above-grade wall area; where the proposed vertical fenestration area is 40 percent or more of the above-grade wall area.	
	U-factor: as specified in Table C402.4	As proposed
	SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: None	As proposed
Skylights	Area 1.The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1. 2.The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1	As proposed

	permitted by Section C402.1	
	U-factor: as specified in Table C402.4	As proposed
	SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
Lighting, interior	The interior lighting power shall be determined in accordance with Section C405.3.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 Watt per square foot (10.7 W/m ²) based on the categorization of buildings with unknown space classification as offices.	As proposed
Lighting, exterior	The lighting power shall be determined in accordance with Table C405.4.2(2) and C405.4.2(3). Areas and dimensions of surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. End-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.
Schedules	Same as proposed Exception: Thermostat settings and schedules for HVAC systems that utilize radiant heating, radiant cooling and elevated air speed, provided that equivalent levels of occupant thermal comfort are demonstrated by means of equal Standard Effective Temperature as calculated in Normative Appendix B of ASHRAE Standard 55.	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
Mechanical ventilation	Same as proposed	As proposed, in accordance with Section C403.2.2.
Heating systems	Fuel type: same as proposed design	As proposed
	Equipment type ^a : as specified in Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: as specified in Tables C403.3.2(4) and C403.3.2(5) the tables in Section C403.3.2.	As proposed
	Capacity ^b : sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type ^c : as specified in Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: as specified in Tables C403.3.2(1), C403.3.2(2) and C403.3.2(3) the tables in Section C403.3.2	As proposed
	Capacity ^b : sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer ^d : same as proposed, in accordance with Section C403.5.	As proposed

Service water heating ^e	Fuel type: same as proposed	As proposed
	Efficiency: as specified in Table C404.2	For <i>Group R</i> , as proposed multiplied by SWHF. For other than <i>Group R</i> , as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit.
	Capacity: same as proposed	As proposed
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	

SWHF = Service water heat recovery factor, DWHR = Drain water heat recovery.

- a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.
- b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.
- c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.
- d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.
- e. The SWHF shall be applied as follows:
 1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then $SWHF = [1 - (DWHR \text{ unit efficiency} \cdot 0.36)]$.
 2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then $SWHF = [1 - (DWHR \text{ unit efficiency} \cdot 0.33)]$.
 3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then $SWHF = [1 - (DWHR \text{ unit efficiency} \cdot 0.26)]$.
 4. Where Items 1 through 3 are not met, $SWHF = 1.0$.

C408.2.3.1 Equipment. Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full-load, part-load and the following emergency conditions:

1. All modes as described in the *sequence of operation*.
2. Redundant or *automatic* back-up mode.
3. Performance of alarms.
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in ~~Tables C403.3.2(1) through C403.3.2(3)~~ the tables in Section C403.3.2 that do not require supply air economizers.

Reason: *These tables have historically come from ASHRAE Standard 90.1. They all represent industry consensus, and are rarely, if ever, intended to be different than 90.1.*

During the last few code cycles, we have noticed that due to the processes, the tables tend to diverge. The reason for this is that public comments to the IECC are due before the final tables are developed and generated for 90.1. Typically, we find errata in the 90.1 tables when we are developing the print version of the standard. Due to timing, those corrections in 90.1 never make it into the IECC. By referencing these tables in 90.1, we ensure that the requirements are aligned. ASHRAE also recognizes that code officials want to have the tables in the book. If this proposal is accepted, ASHRAE has contacted ICC staff about the possibility of reprinting the necessary tables in the IECC as printed in 90.1.

This proposal intends to modify the code by extracting and reprinting the following Tables from ASHRAE Standard 90.1-2019:

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements

Table 6.8.1-2 Electrically Operated Air Cooled Unitary and Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-3 Water-Chilling Packages—Minimum Efficiency Requirements

Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and

Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements

Table 6.8.1-6 Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements

Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements

Table 6.8.1-8 Heat Transfer Equipment—Minimum Efficiency Requirements

Table 6.8.1-9 Electrically Operated Variable-Refrigerant-Flow Air Conditioners—Minimum Efficiency Requirements

Table 6.8.1-10 Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-11 Floor Mounted Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements

Table 6.8.1-13 Commercial Refrigerators, Freezers and Refrigeration—Minimum Efficiency Requirements

Table 6.8.1-14 Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements

Table 6.8.1-15 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements

Table 6.8.1-16 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements

Table 6.8.1-17 Electrically Operated Water Source Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-18 Heat Pump and Heat Reclaim Chiller Packages – Minimum Efficiency Requirements

Table 6.8.1-19 Ceiling Mounted Computer Room Air Conditioners—Minimum Efficiency Requirements

This proposal does add new tables for DOAS units, electrically operated water source heat pumps, heat pump and heat reclaim chiller packages, ceiling mounted computer room air conditioners, and commercial refrigerators and freezers that were previously not covered in the IECC.

The proposal includes six sections and a table which contain specific references to one or more individual tables in Section C403.3.2. In each of these the specific references are replaced by a generic reference to the tables in Section C403.3.2. It is our intent that any other sections which have a specific reference, that it will also be replaced by the generic reference.

Please note that replacement of the IECC tables will result in the following standards no longer being directly referenced in the IECC: AHRI 210/240, AHRI 340/360, AHRI 365, AHRI 390, AHRI 400, AHRI 460, AHRI 560, ANSI/AHAM RAC-1, ANSI Z21.47, ANSI Z83.8, ASHRAE 127, CTI ATC-105, CTI ATC 105S, CTI STD-201 RS, CTI ATC-106, CTI STD 201, ISO 13256-1, ISO 13256-2, UL727, UL731 and NAECA.

Bibliography: ANSI/ASHRAE/IES Standard 90.1

Cost Impact: The code change proposal will not increase or decrease the cost of construction. Some efficiencies in 90.1 for various types of equipment have been changed, and there are some new efficiencies for products that were previously uncovered. In some of those instances, the cost of construction may increase.

CE113-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The change provides better coordination with 90.1 which is available online and updates to federal minimum standards. Only some are federal standards are ASHRAE standards, if we want the numbers changed we need to know which are which. The ASHRAE system is better equipped for dealing with details such as fan efficiency numbers (Vote: 13-2).

Individual Consideration Agenda

Public Comment 1:

IECC@: C403.3.2

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.3.2 HVAC equipment performance requirements (Mandatory). Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(?)(reprinted tables 6.8.1-1 through 6.8.1-19 of ASHRAE Standard 90.1_) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table C403.3.2(10) (reprinted Table 6.8.1-8 of ASHRAE Standard 90.1_). The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein. Table numbering located in parentheses is the table numbers found in ASHRAE 90.1

Table C403.3.2(1)(6.8.1-1) Electrically Operated Unitary Air Conditioners and Condensing Units - Minimum Efficiency Requirements

Table C403.3.2(2)(6.8.1-2) Electrically Operated Air Cooled Unitary and Heat Pumps - Minimum Efficiency Requirements

Table C403.3.2(7)(6.8.1-3) Water Chilling Packages - Minimum Efficiency Requirements

Table C403.3.2(3)(6.8.1-4) Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements

Table C403.3.2(4)(6.8.1-5) Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements

Table C403.3.2(5)(6.8.1-6) Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements

Table C403.3.2(8)(6.8.1-7) Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements

Table C403.3.2(10)(6.8.1-8) Heat Transfer Equipment—Minimum Efficiency Requirements

Table C403.3.2(6)(6.8.1-9) Electrically Operated Variable-Refrigerant-Flow Air Conditioners—Minimum Efficiency Requirements

Table C403.3.2(11)(6.8.1-10) Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps— Minimum Efficiency Requirements[if supportFields]> FILENAME

Table C403.3.2(9)(6.8.1-11) Floor Mounted Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements

Table C403.3.2(12)(6.8.1-13) Commercial Refrigerators, Freezers and Refrigeration—Minimum Efficiency Requirements

Table C403.3.2(13)(6.8.1-14) Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements

Table C403.3.2(14)(6.8.1-15) Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements

Table C403.3.2(15)(6.8.1-16) Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements

Table C403.3.2(16)(6.8.1-17) Electrically Operated Water Source Heat Pumps—Minimum Efficiency Requirements

Table C403.3.2(17)(6.8.1-18) Heat Pump and Heat Reclaim Chiller Packages – Minimum Efficiency Requirements

Table C403.3.2(18)(6.8.1-19) Ceiling Mounted Computer Room Air Conditioners—Minimum Efficiency Requirements

Commenter's Reason: I appreciate the intent of this proposal for there to be one set of numbers for both IECC and 90.1, and I agree with the concern of diverging of numbers. These numbers often come from the minimum federal standards, so going around chasing numbers for both entities is time consuming.

With all of that being said and done this is the IECC, a member of the I-codes family. The numbering of these tables should be in the format of the IECC and not 90.1. What was done for the public comment is the table numbering was taken back to the IECC format, including the added tables not currently found in the IECC, with the 90.1 table format in parentheses to acknowledge that these came from ASHRAE 90.1. This format is similar to what is found in the 2018 IgCC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment is only a clarification to correct table numbering. Clarifications are cost neutral. The proposal cost impact is accurate and therefore, the net effect is cost neutral.

Public Comment# 1959

CE115-19 Part II

IECC: R403.1.2 (IRC N1103.1.2)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

R403.1.2 (IRC N1103.1.2) Heat pump supplementary supplemental heat (Mandatory). Heat pumps having supplementary supplemental electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. Vapor compression cycle can provide the necessary heating to satisfy the thermostat control.

Exceptions:

1. Defrost operation.
2. Vapor compression cycle heating malfunction.
3. Thermostat malfunction.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:

Vapor compression cycle heating malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the energy efficiency standards for heat pumps (both commercial and residential) have increased significantly over the past 25 years. Standards increased again for commercial heat pumps on 1/1/2018, and will increase again as of 1/1/2023. Also, with more heat pumps having "smart" technology, the system owner or facility manager can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Bibliography: "Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small, Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces", 10 CFR Part 431 [Docket Number EERE-2013-BT-STD-0007 and EERE-2013-BT-STD-0021], US Department of Energy, 2016, Pages 32630-32631
Website for more information: https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=35

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a commercial heat pump.

CE115-19 Part II

Public Hearing Results

Errata: This proposal includes no errata
Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

R403.1.2 (IRC N1103.1.2) Heat pump ~~supplementary~~ supplemental heat (Mandatory). Heat pumps having ~~supplementary~~ supplemental electric-resistance heat shall have controls that, ~~except during defrost~~, prevent supplemental heat operation when the heat pump compressor can meet the heating load. ~~V~~ vapor compression cycle can provide the necessary heating to satisfy the thermostat control.

Exceptions:

1. Defrost operation.
2. Vapor compression cycle heating malfunction.
3. Thermostat malfunction.

Committee Reason: The proposal cleans up language and supports systems as they operate today and adds exceptions and additional information for the builder and code official. The modification clarifies language from original proposal (Vote: 10-1).

Assembly Action:

None

CE115-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests Disapprove

Commenter's Reason: "Compression cycle malfunction" and "thermostat malfunction" are not defined in the requirements text. Explanation in the "Reason" statement isn't insufficient to make the change properly enforceable. Is loss of heating capacity in a system due to loss of refrigerant a "malfunction?" If so, this provision would allow continuous heating using electric resistance supplemental heating as the sole source of heat for an indefinite period and waste great amounts of energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The change would retain the current requirements, thereby not affecting construction costs.

Public Comment# 2148

NOTE: CE115-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE115-19 Part I

IECC: Part I: C403.4.1.1 (New)

IECC: Part II: R403.1.2(N1103.1.2) (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C403.4.1.1 Heat pump ~~supplementary-supplemental~~ heat (Mandatory). Heat pumps having ~~supplementary-supplemental~~ electric resistance heat shall have controls that ~~except during defrost, prevent supplementary-supplemental~~ heat operation where the heat pump vapor compression cycle can provide the ~~heating load, necessary heating to satisfy the thermostat control.~~

Exceptions:

1. Defrost operation.
2. Vapor compression cycle malfunction.
3. Thermostat malfunction.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:

Vapor compression cycle heating malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the energy efficiency standards for heat pumps (both commercial and residential) have increased significantly over the past 25 years. Standards increased again for commercial heat pumps on 1/1/2018, and will increase again as of 1/1/2023. Also, with more heat pumps having "smart" technology, the system owner or facility manager can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Bibliography: "Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small, Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces", 10 CFR Part 431 [Docket Number EERE-2013-BT-STD-0007 and EERE-2013-BT-STD-0021], US Department of Energy, 2016, Pages 32630-32631
Website for more information: https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=35

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a commercial heat pump.

CE115-19 Part I

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: Not in support of calling out malfunctioning equipment, preference is for CE116 (Vote: 12-3).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE115-19 Part I

CE116-19 Part I

IECC@: C403.4.1.1

Proposed Change as Submitted

Proponents: Charles Foster, representing self (cfoster20187@yahoo.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C403.4.1.1 Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric resistance heat shall have controls that ~~except during defrost, prevent supplementary heat operation where the heat pump can provide the heating load.~~ limit supplemental heat operation to only those times when:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions, or
4. The thermostat malfunctions.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:

Vapor Compression cycle malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the national energy efficiency standards for residential heat pumps have increased significantly over the past 25 years, and will increase again in January, 2023. Also, with more heat pumps having "smart" technology, the system owner can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a heat pump.

CE116-19 Part I

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This addresses the issue as a backstop for failures and malfunctions, addressing potential safety issues association with equipment failure (Vote: 11-4).

Assembly Action:

None

CE116-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests Disapprove

Commenter's Reason: "Compression cycle malfunction" and "thermostat malfunction" are not defined. Is loss of heating capacity in a system due to loss of refrigerant a "malfunction?" If so, this provision would allow continuous heating using electric resistance supplemental heating as the sole source of heat for an indefinite period and waste great amounts of energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2145

NOTE: CE116-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE116-19 Part II

IECC: R403.1.2 (IRC N1103.1.2)

Proposed Change as Submitted

Proponents: Charles Foster, representing self (cfoster20187@yahoo.com)

2018 International Energy Conservation Code

Revise as follows:

R403.1.2 (IRC N1103.1.2) Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that ~~except during defrost, prevent limit~~ supplemental heat operation to only those times when:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the heat pump compressor can meet the heating load thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions, or
4. The thermostat malfunctions.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:

Vapor Compression cycle malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the national energy efficiency standards for residential heat pumps have increased significantly over the past 25 years, and will increase again in January, 2023. Also, with more heat pumps having "smart" technology, the system owner can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a heat pump.

CE116-19 Part II

Public Hearing Results

Committee Action:

Withdrawn

Assembly Action:

None

CE116-19 Part II

Proposed Change as Submitted

Proponents: Julius Ballanco, JB Engineering and Code Consulting, P.C., representing Daikin US (JBEngineer@aol.com)

2018 International Energy Conservation Code

Revise as follows:

C403.5 Economizers (Prescriptive). Economizers shall comply with Sections C403.5.1 through C403.5.5.

An air or water economizer shall be provided for the following cooling systems:

- 1. Chilled water systems with a total cooling capacity, less cooling capacity provided with air economizers, as specified in Table C403.5(1).
- 2. Individual fan systems with cooling capacity greater than or equal to 54,000 Btu/h (15.8 kW) in buildings having other than a *Group R* occupancy, The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 300,000 Btu/h (88 kW), whichever is greater.
- 3. Individual fan systems with cooling capacity greater than or equal to 270,000 Btu/h (79.1 kW) in buildings having a *Group R* occupancy. The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 1,500,000 Btu/h (440 kW), whichever is greater.

Exceptions: Economizers are not required for the following systems.

- 1. Individual fan systems not served by chilled water for buildings located in *Climate Zones* 1A and 1B.
- 2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35° F (1.7° C) dew-point temperature to satisfy process needs.
- 3. Systems expected to operate less than 20 hours per week.
- 4. Systems serving supermarket areas with open refrigerated casework.
- 5. Where the cooling efficiency is greater than or equal to the efficiency requirements in Table C403.5(2).
- 6. Systems that include a heat recovery system in accordance with Section C403.9.5.
- 7. VRF systems installed with a dedicated outdoor air system.

Reason: VRF (variable refrigerant flow) systems are unique in that they rely on the heating and cooling of the air within a room of space. There is no massive installation of ducts to move air through a central air handling system. Outside air is provided by a dedicated outside air (DOA) system. This type of heating and cooling system does not lend itself to having an economizer. The DOA system would have to be completely oversized in order to accomplish cooling with outside air. That defeats the purpose of this highly efficient heating and cooling system. An analysis was done comparing a VRF system with a DOA system to a typical roof top air handling unit having an economizer cycle. The two areas of the country analyzed were Chicago and Houston. The cooling energy use was compared since economizers provide cooling with outside air. The VRF with DOA used 45.5% less energy to cool a building in Chicago. For the same building in Houston, the VRF with DOA used 32.9% less energy than a rooftop unit.

This proves that a VRF system with a DOA system is more efficient than a standard rooftop unit with an economizer cycle. The code should be modified to recognize this energy savings.

Cost Impact: The code change proposal will decrease the cost of construction. An economizer for a VRF system is very expensive since there would have to be oversizing of DOA ducts and a larger air handler for the DOA system.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This allows builder to take advantage of smaller duct sizes that go along with DOAZ (Vote: 14-1).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: C403.5

Proponents:

Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.5 Economizers (Prescriptive). Economizers shall comply with Sections C403.5.1 through C403.5.5.

An air or water economizer shall be provided for the following cooling systems:

1. Chilled water systems with a total cooling capacity, less cooling capacity provided with air economizers, as specified in Table C403.5(1).
2. Individual fan systems with cooling capacity greater than or equal to 54,000 Btu/h (15.8 kW) in buildings having other than a *Group R* occupancy, The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 300,000 Btu/h (88 kW), whichever is greater.
3. Individual fan systems with cooling capacity greater than or equal to 270,000 Btu/h (79.1 kW) in buildings having a *Group R* occupancy. The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 1,500,000 Btu/h (440 kW), whichever is greater.

Exceptions: Economizers are not required for the following systems.

1. Individual fan systems not served by chilled water for buildings located in *Climate Zones* 1A and 1B.
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35° F (1.7° C) dew-point temperature to satisfy process needs.
3. Systems expected to operate less than 20 hours per week.
4. Systems serving supermarket areas with open refrigerated casework.
5. Where the cooling efficiency is greater than or equal to the efficiency requirements in Table C403.5(2).
6. Systems that include a heat recovery system in accordance with Section C403.9.5.
7. VRF systems installed with a dedicated outdoor air system meeting the requirements of Section C406.6 and the exhaust energy recovery in compliance with Section C403.7.4, without exception. When this exception is used, credit shall not be allowed for Section C406.6.

Commenter's Reason: CE124 provides an exception from economizers for VRF systems that use a dedicated outdoor air system (DOAS) to provide ventilation air. Currently there is no definition of DOAS in Chapter 2 of the IECC and all of the requirements for DOAS are included in Options Packages language contained in C406.6. This Public Comment ensures that there is a link from the DOAS language in this proposed exception to the requirements for DOAS C406.6.

The second part of this Public Comment is to ensure energy recovery ventilation (ERV) is required as part of the DOAS system exception. ERV (see Section C403.7.4) and the minimum recovery efficiency contained within the provision are key components of DOAS. This Public Comment would require that ERV systems always be required for DOAS regardless of number of hours operation and fan CFM.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This public comment is only a clarification to the proposed language as the code already intends for dedicated outdoor air systems to comply with the indicated sections. Clarifications to the code do not impact cost. The proposal's cost impact statement is accurate.

Public Comment 2:

Proponents:

John Bade, Self, representing Self (john.bade-osorio@outlook.com)

requests Disapprove

Commenter's Reason: Thank you for the opportunity to submit comments on Proposal CE124-19. This proposal should be disapproved for the following reasons:

- It will increase energy use.
- “Dedicated outdoor air system” is not defined in the code for the purpose of this exemption.
- It unfairly favors a single type of zone cooling technology over others that are just as efficient.

Increased energy use

Though the proposer only modeled a VRF-DOAS system against an unspecified rooftop system in just two climate zones, the exemption applies to any size and type of building in all climate zones. So, even a large office building where the baseline is a central station VAV system and chiller is the baseline will not need an economizer even in a cool, dry climate zone where most hours are suitable for economizing.

Even VRF advocates recognize that economizing is important. During the committee presentation, a member of the committee noted that the State of Washington already has this provision in their code. But the Northwest Energy Efficiency Alliance (NEEA), one of the main advocates for the Washington’s adoption of code language favorable to VRF recognizes that economizing is important. In their *Very High Efficiency Dedicated Outside Air System Design Specification and Guidelines* (<https://betterbricks.com/uploads/resources/VHE-DOAS-System-Design-Specifications.pdf>) they require that the DOAS unit include an economizer bypass and be sized at twice the required outdoor airflow so that is large enough to provide at least some economizing. They explain this requirement in Note 4 of the specification:

When separating the ventilation function from the heating/cooling function, the outside air connection is not associated with the heating/cooling system, so this function must be provided through the HRV/ERV in order to maintain the ability to increase the number of hours annually during which mechanical cooling (and heating, as well, in some cases) is not required.

The State of Washington’s code (<https://apps.des.wa.gov/sbcc/Page.aspx?nid=116>) does indeed have a VRF economizer exception, but that code contains provisions designed to ensure that the VRF system is designed to save enough energy to make up for the lack of economizing. They include (1) that the VRF be the heat-recovery type, not just a simple heat pump, and (2) that the DOAS system always include exhaust air energy in all cases.

No definition nor requirements for DOAS, including energy recovery

There is no definition of “dedicated outdoor air system” nor requirements for a DOAS in the part of the code that applies to this exemption. It is true that Section 406 does require that the dedicated outside air system include a total energy recovery device to meet the requirements of that section, that requirement does not apply in general. The term “dedicated outdoor air system” does not appear elsewhere in IECC-2018. This will allow designers excessively wide latitude to declare just about any system that provides a significant amount of outside air to be DOAS – even a simple makeup air unit with only a fan and a filter.

Some may have a mistaken impression that DOAS automatically includes energy recovery. In fact, most DX-DOAS units sold in the United States do not include energy recovery. One of the committee members asked if energy recovery would be required, and the proposer correctly cited Section 403.7.4 – Energy recovery ventilation systems and noted that the requirements of this section will apply. But members should understand that very often the requirements of that section do not require that energy recovery be provided.

In section 403.7.4 in “B” and “C” climates energy recovery is only required for large systems that are bigger than the typical DOAS unit. In “A” climates energy recovery there are exceptions that often allow designers to forego recovery.

Exception 7 applies to systems that “employ energy recovery in series with the coil.” Though this is not intended to apply to simple hot-gas reheat systems found in most DX-DOAS units, many users infer that hot-gas reheat systems do fall under this exemption. ASHRAE 90.1 has added language in the 2019 version to clarify this.

Exception 8 allows users to not use exhaust energy recovery if 75% of the design outdoor airflow cannot be recovered at a single location. This exception is often used in buildings with lower outdoor airflow rates, such as offices. Exhaust requirements for bathrooms, locker rooms and other spaces, along with air lost to maintaining positive building pressure often exceeds 25% of the outdoor airflow and automatically relieves users from the requirement to provide energy recovery.

Favoring a single zone-cooling technology

Regardless of the preceding discussion, even those that favor this proposal must be aware that the benefits of VRF cited by the user are not

unique. There are other widely-used zone-cooling systems, such as water-source heat pumps, chilled beam, radiant panels, hydronic fan coils, fan-powered chilled water terminals that provide heating and cooling in a manner much like VRF systems. The language as proposed only applies to VRF systems, and unfairly puts these other systems at a disadvantage. Even if the exception is upheld, at a minimum it must be revised to include all technologies that operate in a similar manner.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2168

CE127-19

IECC@: C403.7.1

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

Revise as follows:

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through 403.5.3 and spaces larger than 500 square feet (46.5 m²) and with an average occupant load of 25 people or greater per 1,000 square feet (93 m²) of floor area, as established in Table 403.3.1.1 of the International Mechanical Code, and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. Systems with energy recovery complying with Section C403.7.4.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. ~~Systems~~ Multiple-zone systems with a design outdoor airflow less than 1,200 cfm (566 L/s).
4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s).
5. Ventilation provided only for process loads.

Reason: Many spaces are over-ventilated due to design professionals establishing ventilation rates based on peak design conditions that rarely exist on a daily basis. Substantial energy savings can be obtained even in low-occupancy areas through the implementation of DCV. CO₂ sensor costs have fallen in recent years making DCV on smaller sized units that already require economizers, (and therefore already have modulating dampers) more cost-effective than they have been in the past.

Cost Impact: The code change proposal will increase the cost of construction

A single CO₂ sensor in the return air duct of a single zone system is expected to cost less than \$300 and provides assurance that indoor air quality in smaller spaces will be maintained to safe CO₂ levels. Note that the requirement for installing DCV is only on units that are already required to have an economizer installed, which drastically reduces the cost of implementing DCV.

CE127-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: We should not put a co sensor in places we do not have people, there is potential to bring in hot humid air. There is unclear use of "ands" and "ors" which a public comment to clarify (Vote: 10-5).

Assembly Action:

None

CE127-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C403.7.1

Proponents:

Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through C403.5.3 and spaces larger than 500 square feet (46.5 m²) and with an average occupant load of ~~25-15~~ people or greater per 1,000 square feet (93 m²) of floor area, as established in Table 403.3.1.1 of the International Mechanical Code, and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. Systems with energy recovery complying with Section C403.7.4.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. Multiple-zone systems with a design outdoor airflow less than ~~4,200-750~~ cfm (~~566-354~~ L/s).
4. ~~Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s). Spaces where >75% of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.~~
5. Ventilation provided only for process loads.

Commenter's Reason: To address committee concerns, language has been modified to avoid possibly requiring DCV on spaces with little to no occupancy. Instead of requiring DCV on all single-zone systems, the occupant density threshold has been reduced from 25 to 15 people per 1000 sqft to maintain a cost-effective level and require more highly variable occupant spaces to implement DCV. In addition, exemptions 3 and 4 have been modified to align with ASHRAE 90.1 language to maintain consistency.

Original reason: One of the common issues we see out in the field is over ventilation of spaces which are based on deign loads and rarely occupied that way. The current code requires DCV to be installed in spaces that are 500sqft and have an occupant density of greater than 25 people per 1,000 sqft. Substantial energy savings can be obtained from lower occupancy spaces through the implementation of DCV. CO2 sensor costs have fallen in recent years making DCV more cost-effective than they have been in the past.

We believe this proposal would help reduce the over-ventilation of spaces that are not covered by DCV currently with a cost-effective control strategy.

Bibliography: Savings based on work done by PNNL for ASHRAE 90.1 to model energy reductions at reduced CFM threshold.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost to implement DCV is a return air CO2 sensor and given current prices of around \$300 can provide a payback of a few months to 2 years depending on the unit size.

Public Comment 2:

IECC@: C403.7.1, TABLE C403.7.1 (New)

Proponents:

Louis Starr (lstarr@neea.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through C403.5.3 and spaces larger than the floor area shown in Table C403.7.1 based on an occupant related outside airflow in cfm per 1000 square feet (L/s-100 m²) 500 square feet (46.5 m²) and with an average occupant load of 25 people or greater per 1,000 square feet (93 m²) of floor area, as established and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. ~~Systems with energy recovery complying with Section C403.7.4. Spaces where greater than 75 percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.~~
2. ~~Multiple zone systems without direct digital control of individual zones communicating with a central control panel. Spaces with one of the following occupancy categories as defined in Table 403.3.1.1 of the International Mechanical Code: correctional facility cells, science laboratories, barber, beauty and nail salons, and bowling alley seating.~~
3. ~~Multiple zone systems with a design outdoor airflow less than 1,200 cfm (566 L/s).~~
4. ~~Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s).~~
- 5.3. Ventilation provided only for process loads.

**TABLE C403.7.1
DEMAND CONTROLLED VENTILATION THRESHOLDS**

Climate Zones	Occupant Related Outside Airflow Rate (CFM/1000 ft ²) ^a							
	112 to 124	125 to 199	200 to 399	≥400	112 to 124	125 to 199	200 to 399	≥400
	Space floor area (ft ²) for spaces served by systems without ERV or HRV				Space floor area (ft ²) for spaces served by systems with ERV or HRV complying with Section C403.7.4			
8	250	225	125	50	450	400	225	100
6A, 6B, 7	450	400	200	100	1,125	1,000	500	250
0B, 1B, 4A, 5A, 5C	600	550	275	150	1,775	1,625	825	450
3A, 4C, 5B	750	675	350	175	2,050	1,850	950	475
2A, 2B	950	850	425	225	1,875	1,675	850	450
3B, 4B	1,300	1,175	575	300	4,950	4,475	2,200	1,150
0A, 1A	2,000	1,800	900	450	4,850	4,375	2,175	1,100
3C	6,000	5,400	2,700	1,375	10,775	9,700	4,850	2,475

For SI: 1 ft² = 0.093 m², 1 CFM/1000 ft² = 0.508 L/s-100 m²

a. An occupant related outside airflow in cfm per 1000 square feet (L/s-100 m²) is calculated as the product of occupant density and per occupant outdoor airflow rate as shown in Table 403.3.1.1 of the International Mechanical Code.

Commenter's Reason: In response to public comment, DCV should be required when cost-effective and for occupied spaces, as well as equitable across varying space sizes, use of energy recovery equipment, and climate zones. This proposal seeks to more effectively align DCV requirements with all those variables to produce a cost-effective solution and bases the square footage threshold requirement on climate zone and occupant airflow rates per 1,000 sqft determined through the IMC. This proposal cleans up unnecessary exemptions and aligns language with submissions to ASHRAE for consideration in the next 90.1 standard.

The exceptions were modified as follows:

- The exhaust air energy recovery exception was removed and replaced with higher floor area thresholds in the table.
- The non-DDC control exception was removed as practically all multi-zone systems installed today have DDC.
- Exceptions were added for spaces that are not recommend for DCV.
- The transfer air exception was simplified and coordinated with ASHRAE 90.1
- The exception for design airflow less than 1,200 cfm was removed, as system size is essentially covered when an economizer is required.

Bibliography: Square foot thresholds based on CFM ranges and code language sourced from PNNL ASHRAE 90.1 analysis.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Since an economizer or motorized dampers are already required as part of the charging language of this section, the cost to add a sensor and wiring is expected to be \$300 or less per unit. The square footage thresholds in the table result in cost effectiveness for a 15 year life control measure, based on a discounted payback of 11.8 years.

CE129-19

IECC@: C403.7.2

Proposed Change as Submitted

Proponents: Nicholas O'Neil, Energy 350, representing Energy 350 (noneil@energy350.com)

2018 International Energy Conservation Code

Revise as follows:

C403.7.2 Enclosed parking garage ventilation controls (Mandatory). Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ ~~contamination-sensing devices~~ carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity, or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with International Mechanical Code provisions. Failure of contamination-sensing devices shall cause the exhaust fans to operate continuously at design airflow.

Exceptions:

1. Garages with a total exhaust capacity less than ~~22,500,000~~ 10,620,375 cfm (~~40,620,3775~~ L/s) with ventilation systems that do not utilize heating or mechanical cooling and use occupant sensors to activate the full required ventilation rate.
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.

Reason: The current threshold for exempting parking ventilation controls ignores a substantial percentage of the parking garage market that could benefit from reduced fan ventilation during times of low (or no) occupancy. The cost of fan system controls and sensors has fallen in recent years making ventilation controls on smaller sized garages more cost-effective than they have been in the past.

Cost Impact: The code change proposal will increase the cost of construction. The primary components required are sensors, controllers and fan variable frequency drives (VFDs). The cost for implementing this code requirement is estimated at \$400 per 1,000 square feet of parking garage, or \$0.40 per square foot. Additionally, the payback for this code proposal is less than 5 years and will be faster for larger garage sizes.

CE129-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The mechanical code indicates how much air to deliver, the IECC indicates when to reduce ventilation - it is valuable to state when both carbon monoxide and dioxide sensors are required and it is appropriate for the IECC to drop the square foot threshold for ventilation rates (Vote: 11-4).

Assembly Action:

None

CE129-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C403.7.2

Proponents:

Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.7.2 Enclosed parking garage ventilation controls (Mandatory). Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity, or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with International Mechanical Code provisions. Failure of contamination-sensing devices shall cause the exhaust fans to operate continuously at design airflow.

Exceptions:

1. Garages with a total exhaust capacity less than 8,000 cfm (3 775 L/s) with ventilation systems that do not utilize heating or mechanical cooling ~~and use occupant sensors to activate the full required ventilation rate.~~
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.

Commenter's Reason: Public comment modifies proposal to remove occupancy sensors for smaller garages to eliminate conflict with IMC on means to safely control ventilation.

Original reason statement: The current threshold for exempting parking ventilation controls ignores a substantial percentage of the parking garage market that could benefit from reduced fan ventilation during times of low (or no) occupancy. The cost of fan system controls and sensors has fallen in recent years making ventilation controls on smaller sized garages more cost-effective than they have been in the past.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Original cost statement: The primary components required are sensors, controllers and fan variable frequency drives (VFDs). The cost for implementing this code requirement is estimated at \$400 per 1,000 square feet of parking garage, or \$0.40 per square foot. Additionally, the payback for this code proposal is less than 5 years and will be faster for larger garage sizes.

Public Comment# 1410

Public Comment 2:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: The energy code should be utilized for components that are considered to be energy provisions. The requirement for the use of carbon monoxide detectors and nitrogen detectors for enclosed parking garages is already required in Section 404.1 of the 2018 IMC, and does not need to be duplicated in the energy code. When you place duplicated sections in two or more of the codes you have the opportunity for these requirements to diverge since they are heard by different committees and during different code cycles. This provision is a good provisions, but the mechanical code is the correct code for these type of requirements to be placed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1507

CE133-19

IECC: SECTION C202 (New), C403.7.4, C403.7.4.1(New), C403.7.4.2(New)

Proposed Change as Submitted

Proponents: Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

ENTHALPY RECOVERY RATIO. Change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage.

Add new text as follows:

C403.7.4 Energy Recovery Systems. Energy recovery ventilation systems shall be provided as specified in either Section 403.7.1 or 403.7.2, as applicable.

C403.7.4.1 Nontransient dwelling units (Prescriptive). Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems with an enthalpy recovery ratio of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. Nontransient dwelling units in Climate Zone 3C.
2. Nontransient dwelling units with no more than 500 square feet (46 m²) of conditioned floor area in Climate Zones 0, 1, 2, 3, 4C, and 5C.
3. Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1, and 2.
4. Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7, and 8.

Revise as follows:

~~**C403.7.4**~~ **C403.7.4.2 Energy recovery ventilation systems Spaces other than nontransient dwelling units (Mandatory).** Where the supply airflow rate of a fan system servicing a space other than a nontransient dwelling unit exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery system. The energy recovery system shall ~~be configured to provide a change in the enthalpy of the outdoor air supply of provide an enthalpy recovery ratio of~~ not less than 50 percent ~~of the difference between the outdoor air and return air enthalpies,~~ at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the International Mechanical Code .
2. Laboratory fume hood systems that include not fewer than one of the following features:
 - 2.1. Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.
 - 2.2. Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.
5. ~~Heating energy~~ Enthalpy recovery ratio requirements in Climate Zones 0, 1 and 2.
6. ~~Cooling energy~~ Enthalpy recovery ratio requirements in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design outdoor air flow rate.
9. Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table C403.7.4(1).
10. Systems exhausting toxic, flammable, paint or corrosive fumes or dust.

11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Reason: This proposal aligns ASHRAE 90.1 and the IECC requirements for energy recovery ventilation systems by:

1) Changing the specification of energy recovery ventilation systems from Mandatory to Prescriptive, and

2) Adding minimum prescriptive path requirements for nontransient* dwelling unit H/ERVs in the prescriptive path, where cost effective.

*Based on the IBC definition of "transient", "nontransient" dwelling units are those that are occupied for more than 30 days; this term carries the same meaning as used in Section 310 of the 2018 IBC.

Prior to the publication of addendum ay to ASHRAE 90.1-2017, both 90.1 and IECC Section C403.7.4 contained energy recovery ventilation requirements that were developed without consideration given for dwelling units within the scope of 90.1 and the IECC. In an effort to develop rational energy recovery ventilation requirements for nontransient dwelling units, 90.1 considered building energy simulations that were conducted on a nominal 1000 ft², 2-bedroom apartment in compliance with the prescriptive path of 90.1 across all climate zones. Four ventilation systems were evaluated for outdoor air: exhaust-only, dedicated supply, central fan integrated supply, and balanced with energy recovery. Ventilation rates were set in accordance with the minimum permitted by ASHRAE 62.2 (comparable to 2018 IMC minimum requirements for mechanical ventilation of high-rise dwelling units). Simulations were run in EnergyPlus. A list of detailed inputs and outputs is also provided in a separate Excel file, with a narrative available in a PowerPoint document. The simulations and accompanying economic analysis resulted in a very favorable scalar ratio (ASHRAE 90.1's metric for cost effectiveness**) for dwelling unit energy recovery ventilation systems in all climate zones except for 3C for typical dwelling units and except for climate zones 0B, 1, 2, 3, 4C, and 5C for small dwelling units (i.e., no more than 500 ft²). Additionally, the proposal exempts all dwelling units in climate zones 0, 1, 2, and 3C from heating energy recovery requirements and climate zones 3C, 4, 5, 6, 7, and 8 from cooling energy recovery requirements based on insignificant savings. This proposal to the IECC mirrors what was vetted and developed over several months by ASHRAE Technical Committee TC5.5 prior to submitting to the 90.1 Mechanical Subcommittee and ultimately approved as addendum ay by the full 90.1 committee.

**A "favorable scalar" is 12.5 or less for heat exchangers with an expected life of 15 years. The economic analysis behind 90.1 addendum ay and this proposal showed an average scalar of 2.9 for the 1008 ft² apartment across all climate zones, and an average of 9.3 for the 500 ft² apartment across all climate zones but the exempted climate zones 0, 1, 2, 3, 4C, and 5C.

For an overview of ASHRAE 90.1's economic model and the scalar method, a presentation summarizing the building energy simulations supporting ASHRAE 90.1 addendum ay and this proposal, and an Excel workbook with the building energy simulation inputs, results, and economic analysis, see this link: <https://www.dropbox.com/sh/tbjpbqyz2tccqk/AADJUnPOLwumQVcJJeVGjsNoa?dl=0>.

Bibliography: Addendum AY to 90.1-2016.

Cost Impact: The code change proposal will increase the cost of construction

By moving the requirement for H/ERVs from the Mandatory path to the Prescriptive path, first costs may be reduced for some projects. For other projects that are not currently required to have H/ERVs in the prescriptive path, would not normally install H/ERVs, and for which this proposal introduces new prescriptive path requirements, the first cost will increase. As explained in the rationale, however, where new requirements are introduced by this proposal, they have been vetted by ASHRAE 90.1 and shown to be cost effective based on energy savings over the useful life of the equipment and a favorable scalar ratio. A detailed explanation of costs and benefits associated with this proposal can be found with this link: <https://www.dropbox.com/sh/tbjpbqyz2tccqk/AADJUnPOLwumQVcJJeVGjsNoa?dl=0>.

CE133-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C403.7.4 Energy Recovery Systems. Energy recovery ventilation systems shall be provided as specified in either Section 403.7.4.1 or 403.7.4.2, as applicable.

C403.7.4.2 Spaces other than nontransient dwelling units (Mandatory). Where the supply airflow rate of a fan system serving a space other than a nontransient dwelling unit exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery system. The energy recovery system shall provide an enthalpy recovery ratio of not less than 50 percent at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

Where energy recovery systems are prohibited by the International Mechanical Code .
Laboratory fume hood systems that include not fewer than one of the following features:

2.1. Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.

2.2. Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.

Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.

Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.

Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.

Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.

Systems requiring dehumidification that employ energy recovery in series with the cooling coil.

Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design outdoor air flow rate.

Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table C403.7.4(1).

Systems exhausting toxic, flammable, paint or corrosive fumes or dust.

Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Committee Reason: This adds important energy savings, energy recovery becomes increasingly important as we tighten the building envelope, the modification clarifies section numbers and exceptions (Vote: 11-4).

Assembly Action:

None

CE133-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests Disapprove

Commenter's Reason: This Code Change Proposal will greatly increase the cost of construction in non-transient dwelling units to an unsustainable level. Per the proponents own supporting documents, the increase in cost of an ERV for a two-bedroom apartment versus other ventilation systems is between \$854 and \$1,198 per dwelling unit. For a 303-unit apartment property (which was the average number of units per property for mid-rise and high-rise apartment properties found in a 2016 National Apartment Association survey) this would equate to an increase in construction cost of approximately \$259,000 to \$363,000 per property.

Bibliography: <https://www.naahq.org/news-publications/units/august-2016/article/2016-naa-survey-operating-income-expenses-rental>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2108

Public Comment 2:

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests Disapprove

Commenter's Reason: This code change would require all apartments except transient to install an energy recovery system and would add significant cost to construction and tenants of these buildings. The cost analysis of this code change was done based on small apartments which do not represent the typical non-transient apartment, the proponent did not take all apartments and the typical size into consideration when conducting

the cost analysis. This change does not make sense in all types of apartments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The code change is approved with add significant cost to construction. However, if disapproved there will be no effect on the cost because there will be no change to the code.

Public Comment# 1655

CE134-19

IECC: C403.7.5, TABLE C403.7.5

Proposed Change as Submitted

Proponents: Guy McMann, Jefferson County, Colorado, representing Colorado Association of Plumbing and Mechanical Officials (CAPMO) (gmcman@jeffco.us)

2018 International Energy Conservation Code

Delete without substitution:

~~**C403.7.5 Kitchen exhaust systems (Mandatory).** Replacement air introduced directly into the exhaust hood cavity shall not be greater than 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space shall not exceed the greater of the following:~~

- ~~1. The ventilation rate required to meet the space heating or cooling load.~~
- ~~2. The hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered to be that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.~~

~~Where total kitchen hood exhaust airflow rate is greater than 5,000 cfm (2360 L/s), each hood shall be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710. Each hood shall have a maximum exhaust rate as specified in Table C403.7.5 and shall comply with one of the following:~~

- ~~1. Not less than 50 percent of all replacement air shall be transfer air that would otherwise be exhausted.~~
- ~~2. Demand ventilation systems on not less than 75 percent of the exhaust air that are configured to provide not less than a 50 percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.~~
- ~~3. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent on not less than 50 percent of the total exhaust airflow.~~

~~Where a single hood, or hood section, is installed over appliances with different duty ratings, the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.~~

~~**Exception:** Where not less than 75 percent of all the replacement air is transfer air that would otherwise be exhausted.~~

**TABLE C403.7.5
MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH**

TYPE OF HOOD	LIGHT-DUTY EQUIPMENT	MEDIUM-DUTY EQUIPMENT	HEAVY-DUTY EQUIPMENT	EXTRA-HEAVY-DUTY EQUIPMENT
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	NA	NA
Backshelf/Pass-over	210	210	280	NA

For SI: 1 cfm = 0.4719 L/s; 1 foot = 305 mm.

NA = Not Allowed.

Reason: These sections are inconsistent with the IMC and was never coordinated for the last two cycles. This requirement is also a job killer in that non-710 hoods over 5000 cfm can no longer be constructed where the IMC still permits it. This does nothing to help the economy whatsoever. This has created a tremendous conflict between the two codes. The unintended consequence is that it results in the inability to re-locate a non-710 hood over 5000 cfm to a new location even though it was lawfully installed at the time. Whats the logic in tossing a perfectly good system and having to spend thousands of dollars to replace it. The table is already in the IMC where it belongs and not in the IECC. Yes a 710 hood moves less air than a non-listed hood but the savings will never be realized if a new system has to be employed. This will eliminate the ability to build a custom hood if a designer so chose to do so. The cost of this code section presents an unfair burden on the owners. This subject matter belongs in the IMC, not the IECC.

Cost Impact: The code change proposal will decrease the cost of construction
Not having to toss a perfectly good system will decrease cost.

CE134-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: This was vetted in 90.1 including manufacturer input, the concern over conflicts with the mechanical code was debated and refuted (Vote 14-1).

Assembly Action:

None

CE134-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Richard Grace, representing VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

requests As Submitted

Commenter's Reason: The committee indicated in their disapproval of this proposal was based on "this was vetted in 90.1 including manufacturer input, the concern over conflicts with the mechanical code was debated and refuted." I am not sure what was debated and refuted, but this could not possibly have been it. When you put the International Mechanical Code (IMC) Section 507.5 next to the International Energy Conservation Code (IECC) Section C403.7.5, the conflict is crystal clear. This is a conflict to minimum life safety requirements outlined in the IMC. The minimum exhaust

flow rates provided in the IMC are there to capture and contain airborne grease particles produced by cooking operations from specific cooking appliances. These rates, along with many other significant changes associated with hood design and performance, were incorporated into the IMC (starting with the 2003 IMC) and were the result of extensive testing by a specialized group of experts, many committee members of ASHRAE 154. This IECC section and table provides for maximum exhaust flow rates. These rates are much less than those minimum rates prescribed by the IMC for non-factory-built hoods. Factory-built hoods are required to be tested to UL 710. In many cases, the IECC maximum rates are much less than the minimum rates prescribed by UL 710 as well.

Looking back on the code change proposal that ultimately placed this section and table into the IECC (CE220-13, included as an attachment with this proposal), the actual intent of the proposal was not to contradict airflow properties prescribed by the IMC or UL 710, but to eliminate the use of short-cycle hoods and to force designers to take more advantage of an HVAC system for use as makeup air for a hood instead of supplying a dedicated makeup air unit. Unfortunately, this was not the right path to accomplish these goals. When the committee disapproved the CE220-13 proposal, they indicated that “the proposal needs better coordination with the International Mechanical Code.” Instead of doing this, the public comment that the proponent submitted provided less coordination and more contradiction. Another problem with this proposal was that the proponent was attempting to align this requirement up with the language contained in AHSRAE 90.1-10 without bringing forth all other pertinent information contained in 90.1. This includes specific definitions contained within 90.1 applicable to this topic, not found or addressed in either IECC or IMC. Also, 90.1 does not dictate that only 710 hoods be installed where the exhaust flow rates exceed 5,000 cfm. That was the proponent’s unusual response to the committee’s disapproval, as the IMC (‘needs better coordination’) does not provide for this requirement either. Other issues that didn’t get carried over accurately from 90.1 include (1) 90.1 section 6.5.7.1.3 references ASHRAE 154 Ventilation for Commercial Cooking Operations, whereas the proposal did not; (2) the exception at the end of this proposal is in a different location in 90.1, changing the meaning of the exception entirely. For all practical purposes, the proponent moved the exception in 90.1 from 6.5.7.1.3 to 6.5.7.1.4. The proposal also left out Section 6.5.7.1.5 entirely. This is not a coordination between codes. With the number of errors contained within, this cannot even constitute a coordination between code and standard.

CE220-13
C403.2.7 (NEW), Table C403.2.7 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sterguson@ashrae.org)

Add new text as follows:

C403.2.7 Kitchen exhaust systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

When total kitchen hood exhaust airflow rate is greater than 5,000 cfm each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following:

1. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted.
2. Demand ventilation systems on at least 75 percent of the exhaust air that are capable of at least 50 percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.
3. Listed energy recovery devices with a sensible heat recovery effectiveness of at least 40 percent on at least 50 percent of the total exhaust airflow.

When a single hood, or hood section, is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

Exception: When at least 75 percent of all the replacement air is transfer air that would otherwise be exhausted

TABLE C403.2.7
MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/Pass-over	210	210	280	Not allowed

Reason: For consistency with Standard 90.1-2010. Considering that the IECC Commercial Provisions are intended to be technically compatible with that standard to facilitate adoption and implementation, ASHRAE is interested in keeping 2012 IECC Commercial Provisions aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

The proposal basically outlaws “short-circuit” hoods. Research and California Energy Commission has shown that direct supply of makeup air, in excess of 10% of hood exhaust airflow, into the hood cavity significantly deteriorates the Capture and Containment (C&C) performance of hoods. This research has also demonstrated that short-circuit hoods waste energy and degrade kitchen environment and hygiene. If we assume a generic baseline C&C rate for a cooking process, studies show the exhaust rates for short-circuit hoods generally exceed those for exhaust-only hoods by at least the amount of air short-circuited, thus decreasing performance and increasing energy consumption.

Engineers are often in the habit of simply providing makeup air units in kitchens to provide makeup air equal to the exhaust flow rate even when "free" transfer air is available from adjacent spaces. Adding makeup air when transfer air is available is a wasteful design practice and should be prohibited. Using available transfer air saves energy and reduces the first cost of the makeup unit and exhaust system in the adjacent spaces. It simply requires some engineering and coordination to provide a path for the transfer air. The proposed change is also intended to get rid of a wasteful common practice: specifying excessive exhaust airflow by selecting hoods that are not listed or have not been subjected to a recognized performance test. The exhaust airflow flow rates in Table C403.2.7 are 30% below the minimum airflow rates in ASHRAE Standard 154-2003.

ASHRAE Research Project 1202 shows that hoods listed per UL Standard 710 and/or are engineered and tested per ASTM/ANSI 1704 have exhaust rates that are at least 30% less than the exhaust airflow requirements for unlisted or untested hoods. The intent is to conserve energy through the use of engineered hoods or performance based hoods that have been validated based on consensus standard test methods. It should be noted that ASHRAE research has not demonstrated that exhaust rate reductions substantially beyond the 30% can or should be recommended at this time. This requirement should not increase first cost and in many cases will reduce first cost through downsizing of exhaust, supply and cooling equipment.

The 5,000 CFM threshold recognizes small restaurants. In addition makeup air can be fully conditioned. As a result there are now cost effective opportunities to reduce energy with demand ventilation systems or energy recovery devices.

Cost Impact: The code change proposal will not increase the cost of construction.

C403.2.7 (NEW)-EC-FERGUSON.doc

Committee Action Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee recognized that there is significant potential for energy savings, but expressed concern that these systems are already difficult to balance properly without this added challenge. The proposal needs better coordination with the International Mechanical Code.

Assembly Action:

None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.2.7 Kitchen Exhaust Systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

When total kitchen hood exhaust airflow rate is greater than 5,000 cfm, each hood shall be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory to comply with the requirements of UL710. Each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following:

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This will make the IECC consistent with 90.1-2010 and 90.1-2013. Considering that the IECC Commercial Provisions are intended to be technically compatible with that standard to facilitate adoption and implementation, ASHRAE is interested in keeping 2012 IECC Commercial Provisions aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. The proposal basically outlaws "short-circuit" hoods.

Research and California Energy Commission has shown that direct supply of makeup air, in excess of 10% of hood exhaust airflow, into the hood cavity significantly deteriorates the Capture and Containment (C&C) performance of hoods. This research has also demonstrated that short-circuit hoods waste energy and degrade kitchen environment and hygiene. If we assume a generic baseline C&C rate for a cooking process, studies show the exhaust rates for short-circuit hoods generally exceed those for exhaust-only hoods by at least the amount of air short-circuited, thus decreasing performance and increasing energy consumption.

Engineers are often in the habit of simply providing makeup air units in kitchens to provide makeup air equal to the exhaust flow rate even when "free" transfer air is available from adjacent spaces. Adding makeup air when transfer air is available is a wasteful design practice and should be prohibited. Using available transfer air saves energy and reduces the first cost of the makeup unit and exhaust system in the adjacent spaces. It simply requires some engineering and coordination to provide a path for the transfer air.

The proposed change is also intended to get rid of a wasteful common practice: specifying excessive exhaust airflow by selecting hoods that are not listed or have not been subjected to a recognized performance test. The exhaust airflow flow rates in Table C403.2.7 are 30% below the minimum airflow rates in ASHRAE Standard 154-2003.

ASHRAE Research Project 1202 shows that hoods listed per UL Standard 710 and/or are engineered and tested per ASTM/ANSI 1704 have exhaust rates that are at least 30% less than the exhaust airflow requirements for unlisted or untested hoods. The intent is to conserve energy through the use of engineered hoods or performance based hoods that have been validated based on consensus standard test methods. It should be noted that ASHRAE research has not demonstrated that exhaust rate reductions substantially beyond the 30% can or should be recommended at this time. This requirement should not increase first cost and in many cases will reduce first cost through downsizing of exhaust, supply and cooling equipment.

The 5,000 CFM threshold recognizes small restaurants. In addition makeup air can be fully conditioned. As a result there are now cost effective opportunities to reduce energy with demand ventilation systems or energy recovery devices. This comment adds a requirement that hoods must be listed (which is required by the IMC to utilize exhaust rates lower than the IMC has for unlisted hood values).

Equipment manufacturers reviewed and agreed to the values proposed in the new table.

To address the Code Development Committee's concerns, this proposal has been modified to be such that hoods must be listed (which is required by the IMC to utilize exhaust rates lower than the IMC has for unlisted hood values).

Staff Note: The UL 710 standard is already a referenced standard in the International Mechanical Code.

CE220-13

Final Action: AS AM AMPC___ D

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This public comment supports the proposal for removal of a code requirement. This will result in a decrease in the cost of construction because custom non-UL710 certified hoods will be able to be used for high flow (above 5000 cfm) applications as the IMC already allows.

Public Comment# 1693

Public Comment 2:

Proponents:

Guy McMann, representing Colorado Association of Plumbing and Mechanical Officials (CAPMO) (gcmcmann@jeffco.us)

requests As Submitted

Commenter's Reason: The committee got this wrong. They seemed more concerned about energy savings thus not seeing the conflict created

between the IECC and the IMC.

There is no technical justification for the 5000 cfm threshold. The IECC Table mandates maximum flow rates where the IMC utilizes minimum flow rates which much research was performed to justify the rates. Maximum rates wont capture and contain grease particals in some circumstances. Existing systems over 500 cfm cannot be relocated even though they were lawfully installed at the time. Custom non-710 hoods over 5000 cfm can no longer be manufactured affecting jobs. Some opponents openly admitted they never looked to the IMC to see if there was a conflict. We request AS. This needs to be deleted.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This public comment supports the proposal for removal of a code limitation. This will result in a decrease in the cost of construction because custom non-UL710 certified hoods will be able to be used for high flow (above 5000 cfm) applications. The IMC already allows for non-UL710 certified hoods to be used currently. This eliminates a costly conflict between the IECC and IMC.

Public Comment# 1169

CE140-19

IECC@: C403.8.5 (New), TABLE C403.8.5 (New)

Proposed Change as Submitted

Proponents: Eric Makela, representing New Buildings Institute (ericm@newbuildings.org); Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Add new text as follows:

C403.8.5 Low-capacity ventilation fans. Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

**TABLE C403.8.5
LOW-CAPACITY VENTILATION FAN EFFICACY**

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. When tested in accordance with HVI Standard 916. Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure \geq 0.2 in. w.c. Fan efficacy for range hoods, bathroom, and utility room fans shall be taken at a static pressure \geq 0.1 in. w.c.

Reason: Exhaust fan efficacies were introduced in the code in 2012 IECC for whole-house ventilation in low-rise residential buildings, but have never been included in the commercial provisions of the IECC. Mid-rise residential occupancies and small commercial buildings often utilize the same small ventilation fans leaving a loophole for a common energy load. These fans are used for point-of-source contaminant exhaust and are frequently utilized as part of a ventilation strategy in multifamily buildings. These fans are also smaller than the threshold for fan size (1/12 HP) that is attached to the other commercial fan requirements. This makes them a common load, and a potentially significant load in multifamily buildings, that is completely unregulated in commercial buildings.

This proposal adopts the table approach already utilized for these fans in the residential section of the code. However, it updates the efficiency requirements. The current residential IECC fan efficacies are from an older version of Energy Star (Version 2.0), so these have been updated to align the latest Energy Star requirement Version 4.0. These fan efficacy values are very conservative based on what is currently on the market.

It sets the efficiency requirement at a level that can reasonably be met by a large number of products available on the market. According to the HVI database of fans, the average efficiency of bath fans is around 7 CFM/W, and the average efficiency of in-line fans is 3.1. This proposal, therefore, places the requirement far below the market average efficiency for bath fans and close to the market average for in-line fans, making this a reasonable requirement.

Another proposal has been submitted to the residential section of the code to update those fan efficacy requirements to the same levels.

Cost Impact: The code change proposal will increase the cost of construction

The proposal could increase the cost of construction. Cost for the kinds of fans covered by this requirement are not driven solely by efficacy. Cost is also a function of flow rate, finishes, design and noise and whether they include other features like lights, sensors, or heaters. In some cases, fans that meet this requirement can be obtained for less other fans that do not. Nevertheless, a comparison of the low-cost exhaust fans shows that this proposal can result in no incremental first costs or short simple paybacks where incremental costs are incurred.

For example, no-frills bath fans from major manufacturers moving a minimum of 50 to ~100 cfm at 0.25" w.c. have an immediate payback (i.e., no cost premium) or a simple payback estimated at \leq 6 years where there is a cost premium (see Tables 1 and 2). The 2021 IRC requires exhaust fans to be rated at a static pressure of 0.25" w.c., which is widely recognized as a typical installed static pressure found in bath fan exhaust ducts.

Table 1. Lowest cost exhaust fans for major manufacturers having a flow rate \geq 50 cfm and < 90 cfm at 0.25" w.c.:

Fan	Efficacy at 0.1" w.c.	Flow at 0.25" w.c.	Price Premium by Manufacturer	Simple Payback (years)
AirKing BFQ75 (compliant with proposal)	3.0	70	--	N/A
AirKing AS70 (entry-level at 0.25" w.c.)	1.4	62	\$11.02	6
Broan AE80B (compliant with proposal)	3.0	60	--	N/A
Broan A70L (entry-level at 0.25" w.c.)	1.7	60	\$1.61	1
DeltaBreeze SLM70 (entry-level at 0.25" w.c. is compliant with proposal)	4.7	54	--	immediate

*Simple payback assumes \$0.1178/kWh (DOE EIA national average for residential and commercial), 1-hour of operation per day. Pricing sourced from homedepot.com on 1/9/2019. For Delta, the lowest price fan having at flow rate \geq 50 cfm and < 90 cfm at 0.25" w.c. also had a fan efficacy meeting the proposed value, so there is no price premium associated with the manufacturer's lowest cost product, and payback is "immediate".

Table 2. Lowest cost exhaust fans for major manufacturers having a flow rate \geq 90 cfm at 0.25" w.c.:

Fan	Efficacy at 0.1" w.c.	Flow at 0.25" w.c.	Price Premium by Manufacturer	Simple Payback (years)
AirKing BFQ140 (entry-level at 0.25" w.c.)	1.6	109	--	N/A
AirKing AK110LS (compliant with proposal)	3.9	90	\$48.32	6
Broan AN110 (entry-level at 0.25" w.c.)	2.3	102	--	N/A
Broan AEN110 (compliant with proposal)	4.7	92	\$41.09	6
DeltaBreeze VFB25AEH (entry-level at 0.25" w.c. is compliant with proposal)	5.9	105	--	immediate
Panasonic FV-08-11VF5 (entry-level at 0.25" w.c. is compliant with proposal)	4.2	104	--	immediate

*Simple payback assumes \$0.1178/kWh (DOE EIA national average for residential and commercial), 4-hours of operation per day (higher run time associated with assumption that higher flow rate bath fans are more likely to be installed in commercial bathrooms which are more likely to run continuously or at longer run times than a typical 1-hour residential assumption). Pricing sourced from homedepot.com on 1/9/2019. For some manufacturers, such as Delta and Panasonic, the lowest price fan having at flow rate ≥ 50 cfm and < 90 cfm at 0.25" w.c. also had a fan efficacy meeting the proposed value, so there is no price premium associated with the manufacturer's lowest cost product, and payback is "immediate".

CE140-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C403.8.5 Low-capacity ventilation fans (Mandatory). Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

TABLE C403.8.5

LOW-CAPACITY VENTILATION FAN EFFICACY^a

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. When tested in accordance with HVI Standard 916. Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure \geq not less than 0.2 in. w.c. Fan efficacy for range hoods, bathroom, and utility room fans shall be taken at a static pressure \geq not less than 0.1 in. w.c.

Committee Reason: The proposal as modified provides cost effective energy savings related to residential ventilation, the modification clarifies the location of the footnote and the mandatory nature of proposal (Vote: 14-1).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

Individual Consideration Agenda

Public Comment 1:

IECC@: C403.8.5 (New), TABLE C403.8.5 (New)

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C403.8.5 Low-capacity ventilation fans. Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5 at one or more rating points.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

**TABLE C403.8.5
LOW-CAPACITY VENTILATION FAN EFFICACYa**

Portions of table not shown remain unchanged.

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. ~~When~~ Air flow shall be tested in accordance with HVI Standard 916 and listed. Efficacy shall be listed, or shall be derived from listed power and air flow. Fan efficacy for fully ducted HRV, ERV, balanced, and in-line fans shall be ~~taken~~ determined at a static pressure not less than 0.2 in. w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be ~~taken~~ determined at a static pressure not less than 0.1 in. w.c.

Commenter's Reason: These edits to the original proposal bring needed clarification for enforcement and coordination with other sections of the code. For example, the clarification that air flow shall be listed aligns with IMC Section 403.3.2.5, as modified by Group A's M28, which was approved as submitted. Additionally, fan efficacy is not listed by industry, but should be determined from listed values of air flow and power draw. The modifications in this public comment are also coordinated with a PC to RE136, to ensure that the IRC and IMC requirements for determining efficacy are aligned.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The original rationale for the code change proposal demonstrates the cost-effectiveness of this measure. The modifications in this PC provide clarifications only and do not impact the proposal's cost effectiveness.

Public Comment# 1917

CE150-19 Part I

IECC@: C403.11.3.1

Proposed Change as Submitted

Proponents: Howard Ahern, representing self (howard.ahern@airexmf.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, ~~equipment maintenance and~~ wind, and physical damage. Protective barrier shall be removable for equipment maintenance and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Reason: Part I of this proposal will clarify the intent of Section C403.11.3.1. Part II of this proposal will clarify the intent of Section R403.4.1. The intent of these sections is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has its intended result the term "equipment maintenance" must be clarified.

The intent is in the original proponents reason statement of this requirement EC207-09/10 which stated this was originally from the ASHRAE 90.1 standard to Harmonize the IECC with ASHRAE 90.1 for the 2012 code the reason statement also stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

Removing protection without damaging the insulation is stated in EC207-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation.

2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

The code section also requires the removal protection to shield from solar radiation that can cause degradation on of the insulation. This sometime get confused with UV protection that is under damage from "sunlight". The additional requirement to shield against solar radiation that is more than just UV, solar radiation also includes heat. Heat is a major factor in the degradation of insulation .UV testing while a good start can be unreliable as it depends on product placement.

Removable protection also allows less costly maintance and replacement of any damaged insulation.

Bibliography: Impact and Advantages of
Removable Insulation Protective Covers

Dr. "Saum" K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE,

LEED AP

2017 ASHRAE Handbook

2012, 2018 IECC Code & Commentary

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, Jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding and they are currently being used all over the US so there no increase cost.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: The proposal provides important clarification of requirements for pipe insulation, proponent is encouraged to return with a public comment to add the words "protective barrier" to the first sentence (Vote: 9-6).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC@: C403.11.3.1

Proponents:

Howard Ahern, representing self (howard.ahern@airexmfg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage by a protective barrier that is removable for equipment maintenance. Protection from damage shall ~~including~~ include that caused by sunlight, moisture, wind, and physical damage. ~~Protective barrier shall be removable for equipment maintenance~~ and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Exception: Chilled water piping system protection is not required to be removable.

Commenter's Reason: This proposal has approved "as submitted" by the committee with a suggestion that a public comment add the words "protective barrier to the first sentence.

The majority of pipe insulation is installed indoors this section only cover exposed or outdoor pipe insulation. There are over 30 manufacturers making a removable protective covers and this Does not even include sheet metal or pipe manufacturers. Protection need to be independent of the insulation. UV is not enough as heat and other factors destroy exposed insulation.

This proposal will clarify the intent of section C403.11.1 this section is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has it's intended result , **the term "equipment maintenance" must be clarified.**

Removable protective barrier will also allow for required visual inspection by the AHJ of refrigerant piping and joint as per the International Mechanical code Chapter 11 section 1107.7 and Uniformed Mechanical Code.

The intent is in the original proponents reason statement of this requirement 2012 IECC proposal EC110-09/10 stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In

every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed.” The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

The ASHRAE handbook states pipe insulation protection must be independent of the insulation and an addition to any factory or field applied vapor retarder.

Removing protection without damaging the insulation is stated in EC110-09/10 “Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state.”

The

majority of pipe insulation is used indoors this section is only for the pipe insulation outdoor or exposed to weather.this proposal will allow competition among manufactures to keep cost down and as there are over 30 manufactures with removable protection products for pipe insulation and this does not even include all the sheet metal manufactures.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation. The 2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

Pipe insulation maintenance is mostly non existence and when there is repair such as elastomeric foam pipe insulation the damaged section is cut out and replaced. Then the slits and joints are glued together with adhesives, but without a protective covering the newly glued slits and joints are exposed to sun, heat, and moisture leading to failed repairs remember a 1% moisture gain is equal to a 7.5 % reduction in thermal efficiency in time leading to a complete failure and the lost of energy this code is trying to save.

The 2018 IECC list many exceptions for chilled water piping systems. In fact vapor retarders which are critical to chilled water piping systems are not even listed in the IECC or IMC.

Vapor retarders are critical to a Chilled system piping insulation as any amount of moisture can lead to disastrous results ,as such chilled water piping systems insulation designers take enormous steps to ensure protection of the insulation. Many such systems are in steel piping that is welded shut to ensure zero moisture, although the piping is removable t is not readily removable.

In collaboration with the North American Insulation Manufacturers Association specifically Charles C. Cottrell Vice President, Technical Services an exception for Chilled water piping system protection to not be required to be removable has been added.

Charles C. Cottrell

Vice President, Technical Services

North American Insulation Manufacturers Association

Ph:

Bibliography:

Impact and Advantages of

Removable Insulation Protective Covers

Dr. “Saum” K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE,

LEED AP

2017 ASHRAE Handbook

2012, 2018 IECC Code & Commentary

Advantages of Using

Removable & Reusable Protective Insulation Covers on Cold, Outdoor Pipes

by Gordon H. Hart, P.E., Consulting Engineer, Artek Engineering, LLC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, Jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding and they are currently being used all over the US so there no increase cost.

Public Comment 2:

IECC@: C403.11.3.1

Proponents:

Howard Ahern, representing self (howard.ahern@airexmfg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, wind, and physical damage. Protective barrier shall be removable for equipment maintenance and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Exception: Chilled Water piping system protection is not required to be removable

Commenter's Reason: This proposal has approved "as submitted" by the committee .

The words "protective barrier " to suggested by the committee to be added to the first sentence , unfortunately however that changed the language and made it less clear.

The original language is clear to understand and follow, this public comment is to add An exception for chilled water system piping in **collaboration with the North American Insulation Manufacturers Association** as justified below.

There are over 30 manufacturers making a removable protective covers(jacket's, cladding, covers, Channel covers, etc.) and this does not even include sheet metal or pipe manufacturers.

Protection needs to be independent of the insulation as ASHRAE states. This IECC code section has always specifically stated "shall be shielded from solar radiation " heat is a major factor in insulation degradation and is not covered by UV test.

Example: Ever put a bicycle in your garage and notice the tires degrading, it was not exposed to UV ? Heat !

There has been 10's of thousand of feet of line set pipe insulation installed in the last few years , and although it had UV there is vast amount of degraded insulation. Inspector, builders , designers have been assured that insulation coating for solar use , where has been national recall due to it melting. Were the thousands of home and building owners notified?

There have been so many pipe insulation protection failures across the country and now there is a wide spread problem with pin hole leaks in copper piping in line set insulation with this plastic factory applied coatings due to bad protection, bad installation, not sealing or covering ends of insulation , corrosive material etc.

This is the text of a letter Armacell issued to the industry

dated September 19, 2017

Subject: Outdoor Protection of White Line Set Insulation

To whom it may concern:

In response to recent questions concerning the longevity of polyethylene insulation when installed outdoors, Armacell believes that there is some misunderstanding about the UV protection provided by the outer coating on white line set (WLS) insulation. The outer coating on WLS is designed to protect the insulation from damage during the installation process. While it is also UV retardant, it will only protect the **insulation from short-term exposure of no more than a year without additional protection** in the form of jacketing or coating. Actual UV performance will vary based on the amount of exposure and other weather conditions. Therefore, especially for longer-term performance, WLS must be protected from sunlight when installed outdoors. This is especially critical for rooftop applications and any other applications where there is high UV exposure.

Sincerely,
Timothy R. Ledden

See also attachment Armacell- "Installation practices observed in the field have been found to compromise the integrity and performance of copper pre-insulated linesets with coated polyethylene insulation material installed and sold primarily into the HVAC industry. A number of key installation deficiencies are identified-

There is a real problem in that much of the insulation being installed under the guise that the insulations factory applied coatings will protect , however these types only have 1 or 3 year warranty against UV but again the code states that it must be shielded from solar radiation (heat) and this is a large part of the degradation. The coating become thermoset crack split etc. allowing moisture into the insulation and it take only 1% moisture gain to lose 7.5 % in thermal efficiency.

Removable Protection will solve all these problems and is the intent of this code section as well as the intent of the code. If we are to gain the energy saving set forth in this section then Removable protection is required.

Protection needs to be removable so:

1. so pipe insulation can be repaired
2. that it protects the glued seams of the repaired insulation without a removable cover the seams are exposed to the weather
3. removable covers can be replaced if damaged to ensure energy savings

Again the majority of pipe insulation is indoors we are only taking about the pipe insulation outdoors.

This proposal will clarify the intent of section C403.11.1 this section is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has it's intended result , **the term "equipment maintenance" must be clarified.**

Removable protective barrier will also allow for required visual inspection by the AHJ of refrigerant piping and joint as per the International Mechanical code Chapter 11 section 1107.7 and Uniformed Mechanical Code.

The intent is in the original proponents reason statement of this requirement 2012 IECC proposal EC110-09/10 stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

The ASHRAE handbook states pipe insulation protection must be independent of the insulation and an addition to any factory or field applied vapor retarder.

Removing protection without damaging the insulation is stated in EC110-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state."

The majority of pipe insulation is used indoors this section is only for the pipe insulation outdoor or exposed to weather.this proposal will allow competition among manufactures to keep cost down and as there are over 30 manufactures with removable protection products for pipe insulation and this does not even include all the sheet metal manufactures.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation. The 2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

Pipe insulation maintenance is mostly non existence and when there is repair such as elastomeric foam pipe insulation the damaged section is cut out and replaced. Then the slits and joints are glued together with adhesives, but without a protective covering the newly glued slits and joints are exposed to sun, heat, and moisture leading to failed repairs remember a 1% moisture gain is equal to a 7.5 % reduction in thermal efficiency in time leading to a complete failure and the lost of energy this code is trying to save.

The 2018 IECC list many exceptions for chilled water piping systems. In fact vapor retarders which are critical to chilled water piping systems are not even listed in the IECC or IMC.

Vapor retarders are critical to a Chilled system piping insulation as any amount of moisture can lead to disastrous results ,as such chilled water piping systems insulation designers take enormous steps to ensure protection of the insulation. Many such systems are in steel piping that is

welded shut to ensure zero moisture, although the piping is removable it is not readily removable.

The exemption is in collaboration with the North American Insulation Manufacturers Association specifically Charles C. Cottrell Vice President, Technical Services

exception for Chilled water piping system protection to not be required to be removable has been added.

Charles C. Cottrell

Vice President, Technical Services

North American Insulation Manufacturers Association

Bibliography: Impact and Advantages of Removable Insulation Protective Covers by Dr. "Saum" K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE.

2017 ASHRAE Handbook.

2012, 2018 IECC Code & Commentary.

Advantages of Using Removable & Reusable Protective Insulation Covers on Cold, Outdoor Pipes by Gordon H. Hart, P.E., Consulting Engineer, Artek Engineering, LLC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding and they are currently being used all over the US so there no increase in cost.

Public Comment# 2128

Public Comment 3:

IECC@: C403.11.3.1

Proponents:

Duane Jonlin, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, wind, and physical damage. Protective barrier shall be removable where required for equipment maintenance and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Commenter's Reason: As currently stated, this code change proposal requires all exterior piping insulation to have removable covering. This change restricts the requirement specifically to those sections of pipe where removal is necessary to service equipment.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment minimizes the cost increase caused by the original proposal. Whereas the original proposal requires removable and reusable covers for *all* exterior insulated piping, this public comment restricts that requirement to only those pipe segments where periodic removal of the covers will be necessary for equipment maintenance. The net effect will still be a cost increase, but a smaller increase.

Public Comment# 2054

Public Comment 4:

Proponents:

Berner, Custom Laminating, representing Custom Laminating

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published. Since this is a two part proposal, we will address our objections to the proposed changes in two parts.

Part I: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. This proposed change will affect *all* outdoor piping systems.

It should be noted that commercial construction is also subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation protection and perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a "removable" jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam provides no resistance to moisture vapor entry. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. The proponent's claims that there is no additional cost are questionable. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don't have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (possibly removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. A fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Lastly, we would request that you ask yourself, "If the jacketing is removed, what do I see or now have access to"? The answer is "the insulation or vapor barrier". *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of a removable jacket other than to benefit the manufacturers of removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Part II: Much of the same argument made for Part I is also applicable to Part II. When discussing Freon systems, we are typically talking about linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent's reason and justification for this code change, I would offer the following comments.

Removable jacketing is not necessary "... to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code". In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory coatings that also provide the required perm rating for refrigerant lines for this application. These coatings are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation as required by code.* Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220° F continuous operation), the insulation is also readily reusable (with the exception of maybe 2" on the ends). It should be further noted that many of these factory coatings are clear or translucent, making inspection of the insulation easier without having to remove the jacket.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

The proponent's cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for moisture condensation control or perm rating. As a simple example, we can use the proponent's removable jacket product as an example. The cost to purchase enough jacket to install over a 5 ft. line at retail is approximately \$40. It is less on a per foot basis, but the scrap is not really usable. So for a \$1 a year annual savings, the ROI to the homeowner would be 40 years. Since this exceeds the life expectancy of the AC equipment, the homeowner will never attain a return

on his investment, even assuming he lives in the house for the 40 years. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is \$0.0962 per kwhr), further extending the time to ROI.

A removable jacket is more likely to allow the ingress of moisture. This will damage the insulation layer and result in addition cost in materials and labor to mitigate. A fully adhered jacket is much less likely to allow ingress of moisture into the insulation.

Public Comment# 1855

Public Comment 5:

Proponents:

Ron Borst, 3M, representing Self (rborst@mmm.com)

requests Disapprove

Commenter's Reason: Commercial construction is subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a permeability not exceeding 0.05 perm per ASTM E 96.

Protection of pipes and pipe insulation is typically accomplished by using a systems approach that includes the installation of a vapor barrier/protective cladding system. When these insulated pipe systems are located outdoors, they are exposed to various weather conditions such as, but not limited to, sunlight, moisture, and wind; as well as physical damage. The current code change request would require that all jacketing be removable.

It's important to note that multiple cladding systems in use today are already removable; if desired. However, by design, such cladding systems are typically tightly sealed using caulks / sealants to keep moisture out. The overall strategy is to do the best possible job to keep wind, water, etc. from getting past the cladding and to protect the vapor barrier and the insulation. Removal and replacement of insulation is cost prohibitive and is generally avoided as much as possible. Even when these pipe systems are being inspected for Corrosion Under Insulation (CUI), considerable effort is made to minimize the removal of insulation during the inspection process. Inspections ports are typically installed to minimize disruption to insulation. Having a jacket that is removable does not help protect the insulation from moisture; especially if it utilizes a hook & loop attachment system (such as VELCRO™), that does not guarantee a water-resistant seal around the insulation. In order to meet current code, a removable cladding system would need to be further sealed itself just to meet existing codes.

Additionally, a removable cladding system doesn't offer any advantages over the existing systems currently in use, because the high cost of insulation replacement would still limit any potential advantages that this removable cladding would offer.

The quality of PVC's varies widely, and some PVC's show a tendency to crack after long term UV exposure. One approach that should be adopted would be to establish specific UV resistance standards.

Our Recommendations:

- Require a high-quality insulation.
- Require integral vapor barrier/ insulation jacketing solution that offers a zero-perm rating and improved insulation protection.
- Require a very specific, UV resistance standard that is more comprehensive than what is currently in place.
- Allow the use of UV resistant adhesive tape products to provide an improved seal on various cladding systems. Tape products can be a very durable, cost effective and efficient means of sealing various cladding materials to ensure the overall cladding system meets code requirements.

The 3M™ VentureClad™ system, for example, is available in both a white and reflective option. It utilizes an adhesive closure system to ensure the insulation is fully sealed when subjected to weather such as, but not limited to, sunlight, moisture and wind which are all required by code; as well as providing an integral zero perm vapor barrier.

All physical properties, statements, and suggestions are either based on tests we believe to be reliable or our experience. There are many factors that can affect the performance of a 3M product, some of which are uniquely within the user's knowledge and control. It is essential that you thoroughly evaluate the VentureClad(TM) product and capability for your method of application and testing

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1985

Public Comment 6:

Proponents:

Charles Cottrell, NAIMA, representing NAIMA

requests Disapprove

Commenter's Reason: The proposed code change adds the requirement that the protective barrier be "removable." This requirement would eliminate the use of PVC jacketing systems that serve very effectively as both a protective barrier and vapor retarder. This is because in order to serve as a vapor retarder on cold pipe systems the joints must be permanently sealed. And if they are sealed, the PVC jacket would not be removable without significant effort to cut the PVC jacketing and remove it from the insulation.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval of this proposal will not change the code and therefore, there will be no impact to cost of construction.

Public Comment# 2051

Public Comment 7:

Proponents:

Anthony Garone, representing Polyguard Products (tgarone@polyguard.com)

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published. Since this is a two part proposal, we will address our objections to the proposed changes in two parts.

Part I: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. This proposed change will affect *all* outdoor piping systems.

It should be noted that commercial construction is also subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation protection and perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a "removable" jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam has a perm rating approaching *infinity*. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. The proponent's claims that there is no additional cost are questionable. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don't have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (possibly removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. A fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Many manufacturers now provide pipe insulation with factory applied, fully adhered jacketing. The application of the jacketing under controlled conditions in a factory allows for a higher quality installation, reduced labor time on a project and reduced installed cost. These popular systems would be eliminated if this code change is approved.

Lastly, we would request that you ask yourself, "If the jacketing is removed, what do I see or now have access to"? The answer is "the insulation or vapor barrier". *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of a removable jacket other than to benefit the manufacturers or removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Part II: Much of the same argument made for Part I is also applicable to Part II. When discussing Freon systems, we are typically talking about linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent's reason and justification for this code change, I would offer the following comments.

Removable jacketing is not necessary "... to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code". In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory coatings that also provide the required perm rating for refrigerant lines for this application. These coatings are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation as required by code*. Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220° F continuous operation), the insulation is also readily reusable (with the exception of maybe 2" on the ends). It should be further noted that many of these factory coatings are clear or translucent, making inspection of the insulation easier without having to remove the jacket.

The proponent's rationale cites an article written by Dr. Saum Nourhamadi, PEX3, Ph.D. CPD, CIPE, CFPE, and LEED AP on the impact and advantages of removable insulation protective covers. While we would be interested in knowing who sponsored this article, the article itself is very flawed. It does not address the basic issues as to whether a removable cover can address the code requirements for moisture protection, corrosion protection and perm rating. It does not weigh the *benefits* of adhered jackets versus the benefits of removable jackets, and the cost savings example is both obsolete due to the introduction of new products and just plain *wrong*. Fully adhered jackets can provide UV, moisture and physical damage protection as well as or better than removable jackets. So the calculations on the cost of damaged insulation become moot as there is no degraded insulation to result in increased energy costs over the life of the equipment. In fact, removable jackets are more likely to result in degraded insulation as they cannot provide an effective moisture, insect or mold, algae or bacteria barrier (think Velcro). Regardless, the math is incorrect. First, 39.5 million is pretty close to the total population of California. But that does not mean that every man, woman and child in the state of California has their own personal outdoor AC unit with 5 feet of exposed refrigerant line. There are approximately 9.6 million *households* in the state, and not all of them have individual AC units. High rise apartment dwellers certainly don't have them. Even multi-unit dwellings don't all have outdoor AC units. But let's assume that they all have an outdoor AC. Using the same half the *households* premise as used by the author, the savings would be 4.8 million households times \$5 annual savings for a total savings of \$24 million annually. This is a far cry from the proponent's alleged \$975 million. The author is off by a factor of 40!

The proponent's cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. We have already demonstrated that this is not the case in Part I. It is not the case in part II either. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for moisture condensation control or perm rating. As a simple example, we can use the proponent's removable jacket product as an example. The cost to purchase enough jacket to install over a 5 ft. line at retail is approximately \$40. It is less on a per foot basis, but the scrap is not really usable. So for a \$1 a year annual savings, the ROI to the homeowner would be 40 years. Since this exceeds the life expectancy of the AC equipment, the homeowner will never attain a return on his investment, even assuming he lives in the house for the 40 years. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is \$0.0962 per kwhr), further extending the time to ROI.

Based on the above, we urge you to disapprove this code change. We would also urge you to consider the following revisions for the next code cycle:

1. Clarify that adhesive tape cannot be applied *directly to the insulation*. Many jacketing systems utilize tape as an accessory to seal their systems, and these tape have a long successful history of outdoor use when used for this purpose.
2. Develop or adopt UV resistance standards. Do not leave this to the discretion of the AHJ. It makes it difficult for manufacturers to compete on a national level and it creates an uneven playing field.
3. Develop or adopt damage resistance standards for the same reason as above.
4. Develop or adopt wind resistance standards for removable jacketing.

Bibliography: see attached file.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The net effect is an increase in the cost of construction, in part because ALL of the stated options cost money and require labor (cost) to install

Public Comment# 1810

Public Comment 8:

Proponents:

Christopher Mueller, Mueller Streamline Co, representing self (cmueller@muellerindustries.com)

requests Disapprove

Commenter's Reason: Pipe insulation should be made more resistant to weather - including UV - but mandating a removable barrier does not ensure better or worse performance or longevity. This change merely supports an individual manufacturer's business goals. Removable barriers that can trap moisture have proven to be detrimental to the underlying tubing. Copper is highly durable in wet environments; however, trapped moisture will eventually develop into aggressive substances that attack the copper tube and cause premature failures and loss of refrigerant. The focus should be on durability and performance, not whether some brand has a Velcro closure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code text. Individual building owners and AHJs can enforce special requirements as desired. This is not appropriate use of a building code requirement.

Public Comment# 2070

Public Comment 9:

Proponents:

Darrell Peil, representing Knauf Insulation (darrell.peil@knaufinsulation.com)

requests Disapprove

Commenter's Reason: INTERNATIONAL CODE COUNCIL, INC.
500 New Jersey Avenue, NW 6th Floor
Washington, DC 20001

July 23, 2019

Dear ICC Review Members,

I am writing in response to the proposal for an amended statement regarding CE150-19 Part I, IECC®: C403.11.3.1 to be included in the 2018 International Energy Conservation Code.

As the Business Development Manager for Commercial and Industrial Insulation for Knauf Insulation, I am recommending that the International Code Council decline to accept the proposed revision to the 2018 International Energy Conservation Code. Knauf Insulation is one of the world's largest producers of mechanical and structural insulation, with 6 manufacturing locations in the United States.

I have represented multiple kinds of insulation materials and finish systems in my 36+ year career in the mechanical insulation industry. I am a current member of ASHRAE TC1.8, ASTM serving on many Task Groups, including those devoted to finish systems, Chair of the National Insulation Association's Technical Insulation Committee, and an editorial member of the National Commercial and Industrial Insulation Standards manual committee.

The proponent states in the proposed revision referencing pipe insulation protection, that the barrier should be removable for equipment maintenance. All supplemental jacketing materials are removable since jacketing is a separate product and operation when added to insulation installations, and removable after installation, some more easily than others. Insulation materials are supplied that have an integral jacketing for the specific reasons given of weather and impact resistance. These jackets are highly satisfactory in providing the desired functions. Many are tested for impact resistance and weatherability. If the insulation system needs work after installation, these finishes/barriers can be removed with the insulation. The term "removable" has a particular connotation in the mechanical insulation industry that can cause confusion and be misconstrued. This is inappropriate to have included.

The exclusion of tape is inappropriate. Excluding this type of product from the code excludes a whole class of products from the market inappropriately and unfairly, that are designed for and provide high-performance protection. Certain tapes are produced from the same materials that are used for

weather and impact resistance, such as polymer films, multi-material laminates, and metallic backings. The adhesives used are designed for long-term, outdoor residence, recognizing the function they are designed to serve. Some products carry 10-year warranty coverage when used outdoors, to lend credence to the use of the products for outdoor service. The adhesives used provide a highly positive method of attachment and closure. In applications where the pipe system is operating at temperatures below ambient temperatures, and vapor-retarder properties are needed, these pressure-sensitive-adhesive protective materials provide the most positive and best performing vapor-retarders. No other weather-protective material does this as well or as cost effectively.

A premise is presented that removing pressure-sensitive-adhesive jackets or tapes will degrade the moisture and water vapor retardant ability of insulation materials. No insulation product has the inherent water and water-vapor resistance properties deteriorated by removing pressure-sensitive jackets. Water and water vapor-resistance properties of insulation materials, no matter how good or how bad, are uniform through the entire matrix of the material. There are insulation materials that have a competitive advantage because superior moisture and water vapor resistance properties do go through the entire thickness of the material. These materials are unchanged because of the homogenous nature of these products. Removal of the outer surface does not change the property.

A reference to thermoset materials is made, indicating materials achieve the property of becoming a thermoset material after insulation. Insulation made from polymers are determined to be thermoset materials at the time of chemical formulation, not based on exposure to elements. Vulcanized synthetic rubber, used as insulation, is a thermoset polymer. The product maintains flexibility after the vulcanizing process. Thermoplastic polymers cannot be transformed to thermoset polymers. The thermoset is achieved in the vulcanizing portion of the production process, much the same as making a tire. There is no changing this. Thermoset materials are no different in their ability to resist weather deterioration and damage after installation.

The premise of HVAC equipment maintenance is discussed. Most HVAC equipment maintenance procedures do not require accessing the insulated piping that carries the refrigerant. Most service is conducted inside the condenser unit cabinet that contains the compressor, condensing coil, condenser fan motor, contactors, capacitors, circuit boards, valves and wiring. The refrigerant piping is almost never serviced, except when the condensing unit is disconnected from the piping. No routine service happens on this part of the system. Secondly, if the piping or equipment beneath the insulation needs to be serviced, the insulation AND the protective finish must be removed. Replacement with new material is standard in the rare instance that this operation must be performed.

The precept that all insulation cannot withstand impacts or direct weather exposure is erroneous. There are insulation materials that are resistant to the effects of weather and impacts as produced. The flexibility and compressibility of the materials, along with the chemical formulation, provide these properties. This is much the same as automotive rubber, like tires, belts, hoses, gaskets and other building materials such as roofing, glazing gaskets and sealants.

The premise that solar radiant heat gain damages all insulation is not sound. Insulation is designed for heat and cold, and to control the flow of energy between the two conditions. Like all materials, there are an array of formulations of insulation materials. The material used to produce the insulation has a significant impact on the material's ability to resist heat degradation. It is important to specify the correct insulation type for the application. This is a base selection criteria used in all insulation system selection.

The savings calculations presented by the proponent Ahern applies to the insulation material, not the jacket. The jacket lends no savings to the system. Some jacketings detract from the ability of the system to retard energy flow. Part of a proper system design includes compensation for the added energy flow that can be caused by certain protective finishes, and may change the selection of the protective finish to avoid the added flow/loss caused by the finish.

The proponent goes on to discuss savings of installation and maintenance. Protective finishes on insulation systems generally double the cost of the insulation installation. The assertion of no impact on construction cost is erroneous. The assumption of reduced costs of damaged insulation systems is erroneous. When the insulation is compromised, the entire system is removed and replaced, including protective finishes. This is a base requirement and assumption to properly restore the system.

Properly installed and sealed insulation systems are required to deliver long-term performance. The system is the insulation material itself, and any kind of finish that achieves the desired goals of the design professional, including avoiding weather intrusion, insect infestation, water vapor, ice, and other deleterious impacts. A system that is not properly applied and sealed will not provide long-term function. This includes a seal that is complete and will not pass moisture or water vapor for below-ambient operation systems.

The proponent makes a reference to the 2017 ASHRAE Handbook. The only Handbook published in 2017, is the Handbook of Fundamentals. As the Chair of the 2013 TC1.8 Handbook subcommittee, and a member of ASHRAE TC1.8 for the Handbook, I am intimately familiar with the contents of Chapter 23, Mechanical Insulation for HVAC Systems. The 2013 version was adopted for 2017, with no changes. References to finish and jacketing systems are very neutral and no specific direction is given regarding one kind of finish or the other.

The code language proposed could be considered to restrict the use of common insulation finish systems from outdoor use, that are specifically designed for, highly suited for, and effective in outdoor applications for all kinds of systems.

Please consider the above comments as proposed changes are reviewed for adoption.

Regards,
Darrell Peil, Business Development, Commercial & Industrial
Knauf Insulation
Darrell.peil@knaufinsulation.com
<http://www.imanson.com>
<https://www.knaufinsulation.us/>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1929

Public Comment 10:

Proponents:

William Ronca, K-Flex USA, representing K-Flex USA (bill.ronca@kflexusa.com)

requests Disapprove

Commenter's Reason: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published.

It should be noted that commercial construction is also subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation / corrosion protection and the specified perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a "removable" jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam has a perm rating greater than 100. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket. The proponent's claims that there is no additional cost are questionable.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don't have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (usually removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would potentially eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. In the event of a jacketing failure, a fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small, confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Many manufacturers and fabricator / distributors now provide pipe insulation with factory applied, fully adhered jacketing. The application of the jacketing under factory controlled conditions allows for a higher quality installation, reduced labor time on a project and reduced installation cost. These popular systems would be eliminated if this code change is approved.

Lastly, we would request that you ask yourself, "If the jacketing is removed, what do I see or now have access to"? The answer is "the insulation or vapor barrier". *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of requiring a removable jacket other than to benefit the manufacturers or removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment 11:**Proponents:**

Louis Walton, representing VP Sales & Marketing (louis@protocorporation.com)

requests Disapprove

Commenter's Reason: Reference: ICC Proposed code changes:
CE150-19 Part I and CE150-19 Part II

July 23, 2019

Opponent: Louis Walton – Proto Corporation

Requested Action: Disapproval

Reason: The code changes as proposed, are flawed and if implemented will contribute to “in-field failures” to the insulation system.

Currently insulation packages are fully sealed with appropriate vapor barriers to prevent condensation within the insulation system and surrounding areas. These systems also provide exterior protection for abuse and outside use.

If this type of system is not used then the insulation package will be compromised and the following types of issues may occur:

- Icing within the system
- Potential for mold growth
- Reduced Insulating value
- System expansion possibly leading to piping failure

For any below ambient piping, including air conditioning tubing, the insulation system **must be** fully sealed.

As with any pipe maintenance, including air conditioning repairs, appropriate steps must be taken to ensure that the insulation system is returned to its original condition after the repairs are completed. In many cases the insulation and barriers may be reused. This assumes that the worker is properly trained and has the appropriate materials to repair the insulation system and provide the necessary vapor barrier.

- Self-sealing tape (double sided acrylic based)
- Butt strips or sealing tape (acrylic based)
- ASJ jacketing
- PVC or CPVC jacket or strips
- Vapor barrier mastic
- Additional insulation

A barrier, which is designed to be removed, by its very nature is not designed to provide a sealed system. If this type of system is required, by this proposed code change, the use of it will result in field failures. A removable barrier may provide protection for exposure to outdoor, impact resistance, and act as a liquid watershed, but it is not designed to provide a vapor seal. Without this vapor barrier seal the aforementioned issues may occur. This type of failure would be very costly to the end user.

As part of this proposal the justification to use a removable barrier referenced potential energy savings. This reference appears to be incorrect, since all of the air conditioning systems referenced are currently protected using an industry approved insulation system.

If the ICC wants to strengthen the wording of this section of the code perhaps they should consider requiring the individual working on an air conditioning system be trained to remove, re-install or replace the insulation package. This would minimize the potential for field failures and have a minimal cost to the end user.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1891

CE150-19 Part II

IECC: R403.4.1 (IRC N1103.4.1)

Proposed Change as Submitted

Proponents: Howard Ahern, representing self (howard.ahern@airexmfg.com)

2018 International Energy Conservation Code

Revise as follows:

R403.4.1 (IRC N1103.4.1) Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, ~~wind and physical damage~~. ~~Protective barrier shall be removeable for equipment maintenance and wind.~~ ~~The protection shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall be prohibited.~~

Reason: Part I of this proposal will clarify the intent of Section C403.11.3.1. Part II of this proposal will clarify the intent of Section R403.4.1. The intent of these sections is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has its's intended result the term "equipment maintenance" must be clarified.

The intent is in the original proponents reason statement of this requirement EC207-09/10 which stated this was originally from the ASHRAE 90.1 standard to Harmonize the IECC with ASHRAE 90.1 for the 2012 code the reason statement also stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

Removing protection without damaging the insulation is stated in EC207-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation.

2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

The code section also requires the removal protection to shield from solar radiation that can cause degradation on of the insulation. This sometime get confused with UV protection that is under damage from "sunlight". The additional requirement to shield against solar radiation that is more than just UV, solar radiation also includes heat. Heat is a major factor in the degradation of insulation .UV testing while a good start can be unreliable as it depends on product placement.

Removable protection also allows less costly maintance and replacement of any damaged insulation.

Bibliography: Impact and Advantages of
Removable Insulation Protective Covers

Dr. "Saum" K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE,

LEED AP

2017 ASHRAE Handbook

2012, 2018 IECC Code & Commentary

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, Jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding

and they are currently being used all over the US so there no increase cost.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: This is needed to protect the insulation and ensure it is removable (Vote: 9-2).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Troy Anderson, H.B. Fuller Company, representing H.B. Fuller Company

requests Disapprove

Commenter's Reason: The change to the code to require jacketing be removable does not consider the need to remove the insulation or jacketing in areas where maintenance is not required and does not acknowledge that there are many types of insulation systems available and that some systems may benefit from fully adhered jacketing such as mastics and coatings or adhesive tape type jacketing for the reasons as follows. The owner and specifiers should have the ability to design an implement the most cost effective total solution considering all factors for their specific system whether that include removable jackets or where a fully adhered jacket may provide the best weather protection at the best performance and cost.

1. Not all piping in the system would require maintenance or be affected by equipment maintenance so the need to have the insulation or jacketing removable over the entire pipe would not seem necessary. It would only affect that piping immediately adjacent to the equipment.
2. This change does not properly address the need for a continuous vapor retarder system with the insulation. Whether the jacketing is bonded to the insulation, such as would be the case with mastics and coatings or adhesive tape types, or the jacketing is removable once the insulation itself is disturbed the vapor retarder system will require repair. Vapor retarder mastics and adhesive bonded vapor retarder jackets, such as aluminum laminate tapes, have the advantage of being able to visually confirm the continuance of the vapor retarder and the integrity or existence of the underlying insulation. Simply re-installing a removable jacket over an insulated pipe does not address or ensure a proper vapor retarder for the insulation system or the integrity of the underlying insulation.
3. The argument that removable jackets can be replaced or repaired if damaged is no different than adhered vapor retarder jacketing or coatings. These may also be repaired. In fact in some cases the fact the vapor retarder is adhered to the insulation surface may be an advantage if damage occurs. The adhered system will not allow the movement of water or water vapor between the insulation surface and the jacket confining the damage just to the area where the damage occurred and continuing to provide the vapor retarder in unaffected areas. Removable jacketing will allow moisture to travel between the jacket and the insulation and provides no additional vapor retarder to the system.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment 2:

Proponents:

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published. Since this is a two part proposal, we will address our objections to the proposed changes in two parts.

Part I: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. This proposed change will affect *all* outdoor piping systems.

It should be noted that commercial construction is also subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation protection and perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a "removable" jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam provides no resistance to moisture vapor entry. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. The proponent's claims that there is no additional cost are questionable. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don't have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (possibly removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. A fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Lastly, we would request that you ask yourself, "If the jacketing is removed, what do I see or now have access to"? The answer is "the insulation or vapor barrier". *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of a removable jacket other than to benefit the manufacturers of removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Part II: Much of the same argument made for Part I is also applicable to Part II. When discussing Freon systems, we are typically talking about linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent's reason and justification for this code change, I would offer the following comments.

Removable jacketing is not necessary "... to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code". In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory coatings that also provide the required perm rating for refrigerant lines for this application. These coatings are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation as required by code*. Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220° F continuous operation), the insulation is also readily reusable (with the exception of maybe 2" on the ends). It should be further noted that many of these factory coatings are clear or translucent, making inspection of the insulation easier without having to remove the jacket.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The proponent's cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for moisture condensation control or perm rating. As a simple example, we can use the proponent's removable jacket product as an example. The cost to purchase enough jacket to

install over a 5 ft. line at retail is approximately \$40. It is less on a per foot basis, but the scrap is not really usable. So for a \$1 a year annual savings, the ROI to the homeowner would be 40 years. Since this exceeds the life expectancy of the AC equipment, the homeowner will never attain a return on his investment, even assuming he lives in the house for the 40 years. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is \$0.0962 per kwhr), further extending the time to ROI.

A removable jacket is more likely to allow the ingress of moisture. This will damage the insulation layer and result in addition cost in materials and labor to mitigate. A fully adhered jacket is much less likely to allow ingress of moisture into the insulation.

Public Comment# 1856

Public Comment 3:

Proponents:

Ron Borst, representing Self (rborst@mmm.com)

requests Disapprove

Commenter's Reason: R403.11.3.1 Protection of piping insulation (Mandatory) states that the piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind. That protection shall provide shielding from solar radiation that can cause degradation of the material.

The change noted in the original proposed code change is "protective barrier shall be removable" for equipment maintenance. The claim is that all AC units require periodic maintenance and that all maintenance work provides an opportunity for any damaged Freon line insulation to be replaced. Maintenance on AC units, such as, but not limited to, getting temperatures and pressures from the line sets, do not always require the insulation "to be touched or removed" as stated in the code change request.

Also, it is claimed that a removable cover would enable easier insulation replacement. Requiring a removable insulation cover presupposes that a lower quality insulation was installed. A high-quality insulation would provide a much longer service life, provided the insulation is well protected, as currently required in the code.

In the proposed code change, the claim is made that insulation materials are fragile to many elements, including the heat generated by sunlight. The claim also asserts that this sunlight induced heat enhances the transformation of the insulation from a thermoplastic (soft) foam to a thermoset (brittle) foam. This is not a true statement for higher quality insulation, such as EPDM, when it is properly protected per the existing code. Based on the lifespan of many of these types of high-quality insulation materials in an industrial setting, where they are often exposed to a high heat environment; high quality elastomeric insulations are not inherently broken down by heat. Requiring a high-quality insulation, that does not break down with heat, would be a more cost effective and efficient solution. Furthermore, if it is desired to protect high quality elastomeric insulation, such as EPDM, from sunlight induced heat in a residential setting, the easiest and most cost-effective means would be to require that the covering that is used be either white or reflective.

Many of the insulation coverings suggested in the proposed code change, such as sheet metal, aluminum covers, jackets, and metal cladding would likely require additional labor costs to install due to the need to form, shape and install them. Additionally, these materials would not necessarily be easy to remove after installation, due to the inherent need for fasteners, sealants, etc. Furthermore, while the insulation covers listed above likely provide very good UV protection, these types of insulation covers often require the application of a sealant to meet other code requirements for protecting the insulation from moisture and wind. The need for sealants increases the complexity of installation and the cost.

The quality of PVC's varies widely, and some PVC's show a tendency to crack after long term UV exposure. One approach that should be adopted would be to establish specific UV resistance standards. Additionally, the current PVC/hook & loop system that is part of the code change request is likely not capable of providing moisture protections to the insulation, and therefore would not meet code requirements. In order to meet the requirements, a sealant or tape product would be needed to completely seal the removable cover.

Our Recommendations:

- Require a high-quality insulation.
- Require integral vapor barrier/ insulation jacketing solution that offers a zero-perm rating and offers improved insulation protection.
- Require a very specific, UV resistance standard that is more comprehensive than what is currently in place.
- Require the use of a white or reflective surface finish to diminish the effect of heat absorption on the insulation.
- Allow the use of UV resistant adhesive tape products to provide an improved seal on various cladding systems. Tape products can be a very durable, cost effective and efficient means of sealing various cladding materials to ensure the overall cladding system meets code requirements.

The 3M™ VentureClad™ product, for example, is available in both a white and reflective option. It utilizes an adhesive closure system to ensure the insulation is fully sealed when subjected to weather such as, but not limited to, sunlight, moisture and wind which are all required by code; as well as providing an integral zero perm vapor barrier. Restricting the use of an adhesive based system such as is currently being requested, would not be

in the best interest on homeowners or contractors.

All physical properties, statements, and suggestions are either based on tests we believe to be reliable or our experience. There are many factors that can affect the performance of a 3M product, some of which are uniquely within the user's knowledge and control. It is essential that the you thoroughly evaluate the 3M VentureClad™ product and capability for your method of application and testing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2029

Public Comment 4:

Proponents:

Charles Cottrell, NAIMA, representing NAIMA

requests Disapprove

Commenter's Reason: The proposed code change adds the requirement that the protective barrier be "removable." This requirement would eliminate the use of PVC jacketing systems that serve very effectively as both a protective barrier and vapor retarder. This is because in order to serve as a vapor retarder on cold pipe systems the joints must be permanently sealed. And if they are sealed, the PVC jacket would not be removable without significant effort to cut the PVC jacketing and remove it from the insulation.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction No change to code.

Public Comment# 2053

Public Comment 5:

Proponents:

Christopher Mueller, representing self (cmueller@muellerindustries.com)

requests Disapprove

Commenter's Reason: Pipe insulation should be made more resistant to weather - including UV - but mandating a removable barrier does not ensure better or worse performance or longevity. This change merely supports an individual manufacturer's business goals. Removable barriers that can trap moisture have proven to be detrimental to the underlying tubing. Copper is highly durable in wet environments; however, trapped moisture will eventually develop into aggressive substances that attack the copper tube and cause premature failures and loss of refrigerant. The focus should be on durability and performance, not whether some brand has a Velcro closure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code text. Individual building owners and AHJs can enforce special requirements as desired. This is not appropriate use of a building code requirement.

Public Comment# 2081

Public Comment 6:

Proponents:

Darrell Peil, representing Knauf Insulation (darrell.peil@knaufinsulation.com)

requests Disapprove

Commenter's Reason: INTERNATIONAL CODE COUNCIL, INC.
500 New Jersey Avenue, NW 6th Floor

Washington, DC 20001

July 23, 2019

Dear ICC Review Members,

I am writing in response to the proposal for an amended statement regarding CE150-19 Part I, IECC®: C403.11.3.1 to be included in the 2018 International Energy Conservation Code.

As the Business Development Manager for Commercial and Industrial Insulation for Knauf Insulation, I am recommending that the International Code Council decline to accept the proposed revision to the 2018 International Energy Conservation Code. Knauf Insulation is one of the world's largest producers of mechanical and structural insulation, with 6 manufacturing locations in the United States.

I have represented multiple kinds of insulation materials and finish systems in my 36+ year career in the mechanical insulation industry. I am a current member of ASHRAE TC1.8, ASTM serving on many Task Groups, including those devoted to finish systems, Chair of the National Insulation Association's Technical Insulation Committee, and an editorial member of the National Commercial and Industrial Insulation Standards manual committee.

The proponent states in the proposed revision referencing pipe insulation protection, that the barrier should be removable for equipment maintenance. All supplemental jacketing materials are removable since jacketing is a separate product and operation when added to insulation installations, and removable after installation, some more easily than others. Insulation materials are supplied that have an integral jacketing for the specific reasons given of weather and impact resistance. These jackets are highly satisfactory in providing the desired functions. Many are tested for impact resistance and weatherability. If the insulation system needs work after installation, these finishes/barriers can be removed with the insulation. The term "removable" has a particular connotation in the mechanical insulation industry that can cause confusion and be misconstrued. This is inappropriate to have included.

The exclusion of tape is inappropriate. Excluding this type of product from the code excludes a whole class of products from the market inappropriately and unfairly, that are designed for and provide high-performance protection. Certain tapes are produced from the same materials that are used for weather and impact resistance, such as polymer films, multi-material laminates, and metallic backings. The adhesives used are designed for long-term, outdoor residence, recognizing the function they are designed to serve. Some products carry 10-year warranty coverage when used outdoors, to lend credence to the use of the products for outdoor service. The adhesives used provide a highly positive method of attachment and closure. In applications where the pipe system is operating at temperatures below ambient temperatures, and vapor-retarder properties are needed, these pressure-sensitive-adhesive protective materials provide the most positive and best performing vapor-retarders. No other weather-protective material does this as well or as cost effectively.

A premise is presented that removing pressure-sensitive-adhesive jackets or tapes will degrade the moisture and water vapor retardant ability of insulation materials. No insulation product has the inherent water and water-vapor resistance properties deteriorated by removing pressure-sensitive jackets. Water and water vapor-resistance properties of insulation materials, no matter how good or how bad, are uniform through the entire matrix of the material. There are insulation materials that have a competitive advantage because superior moisture and water vapor resistance properties do go through the entire thickness of the material. These materials are unchanged because of the homogenous nature of these products. Removal of the outer surface does not change the property.

A reference to thermoset materials is made, indicating materials achieve the property of becoming a thermoset material after insulation. Insulation made from polymers are determined to be thermoset materials at the time of chemical formulation, not based on exposure to elements. Vulcanized synthetic rubber, used as insulation, is a thermoset polymer. The product maintains flexibility after the vulcanizing process. Thermoplastic polymers cannot be transformed to thermoset polymers. The thermoset is achieved in the vulcanizing portion of the production process, much the same as making a tire. There is no changing this. Thermoset materials are no different in their ability to resist weather deterioration and damage after installation.

The premise of HVAC equipment maintenance is discussed. Most HVAC equipment maintenance procedures do not require accessing the insulated piping that carries the refrigerant. Most service is conducted inside the condenser unit cabinet that contains the compressor, condensing coil, condenser fan motor, contactors, capacitors, circuit boards, valves and wiring. The refrigerant piping is almost never serviced, except when the condensing unit is disconnected from the piping. No routine service happens on this part of the system. Secondly, if the piping or equipment beneath the insulation needs to be serviced, the insulation AND the protective finish must be removed. Replacement with new material is standard in the rare instance that this operation must be performed.

The precept that all insulation cannot withstand impacts or direct weather exposure is erroneous. There are insulation materials that are resistant to the effects of weather and impacts as produced. The flexibility and compressibility of the materials, along with the chemical formulation, provide these properties. This is much the same as automotive rubber, like tires, belts, hoses, gaskets and other building materials such as roofing, glazing gaskets and sealants.

The premise that solar radiant heat gain damages all insulation is not sound. Insulation is designed for heat and cold, and to control the flow of energy between the two conditions. Like all materials, there are an array of formulations of insulation materials. The material used to produce the insulation has a significant impact on the material's ability to resist heat degradation. It is important to specify the correct insulation type for the application. This is a base selection criteria used in all insulation system selection.

The savings calculations presented by the proponent Ahern applies to the insulation material, not the jacket. The jacket lends no savings to the system. Some jacketings detract from the ability of the system to retard energy flow. Part of a proper system design includes compensation for the added energy flow that can be caused by certain protective finishes, and may change the selection of the protective finish to avoid the added flow/loss caused by the finish.

The proponent goes on to discuss savings of installation and maintenance. Protective finishes on insulation systems generally double the cost of the insulation installation. The assertion of no impact on construction cost is erroneous. The assumption of reduced costs of damaged insulation systems is erroneous. When the insulation is compromised, the entire system is removed and replaced, including protective finishes. This is a base requirement and assumption to properly restore the system.

Properly installed and sealed insulation systems are required to deliver long-term performance. The system is the insulation material itself, and any kind of finish that achieves the desired goals of the design professional, including avoiding weather intrusion, insect infestation, water vapor, ice, and other deleterious impacts. A system that is not properly applied and sealed will not provide long-term function. This includes a seal that is complete and will not pass moisture or water vapor for below-ambient operation systems.

The proponent makes a reference to the 2017 ASHRAE Handbook. The only Handbook published in 2017, is the Handbook of Fundamentals. As the Chair of the 2013 TC1.8 Handbook subcommittee, and a member of ASHRAE TC1.8 for the Handbook, I am intimately familiar with the contents of Chapter 23, Mechanical Insulation for HVAC Systems. The 2013 version was adopted for 2017, with no changes. References to finish and jacketing systems are very neutral and no specific direction is given regarding one kind of finish or the other.

The code language proposed could be considered to restrict the use of common insulation finish systems from outdoor use, that are specifically designed for, highly suited for, and effective in outdoor applications for all kinds of systems.

Please consider the above comments as proposed changes are reviewed for adoption.

Regards,

Darrell Peil, Business Development, Commercial & Industrial
Knauf Insulation

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<http://www.imanson.com>

<https://www.knaufinsulation.us/>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1930

Public Comment 7:

Proponents:

Charles Petty, Lamtec Corporation, representing Lamtec Corporation (pettycharlie@lamtec.com)

requests Disapprove

Commenter's Reason: This proposal would make removable/reusable "protective barriers" (protective jacket) mandatory on piping insulation. I am opposed to this restriction, as it does not prevent damage or destruction of properly vapor-sealed insulation that is removed, and it could lead to mis-use of the product as a vapor retarder

The closures of removable jacketing are necessarily *temporary* and therefore not vapor-resistant. For instance, it would seem quite apparent that the Velcro type closure used on some products can offer no appreciable resistance to vapor flow, even though the base jacket material may be an adequate vapor retarder. I am not aware of published permeance values for the "resealable" closures, but certainly such data should be reviewed before a removable jacket could even be considered allowable for use as a combination vapor retarder. To provide adequate vapor resistance for below-ambient piping, a properly sealed vapor retarder or properly sealed low permeance insulation must be used; removable protective "barriers" will not provide the necessary level of vapor retardance.

While a removable jacket could be taken off and replaced, the same does not hold true for the sealed insulation and/or vapor retarder underneath it. With a properly sealed below-ambient insulation system, it will not be possible to remove the insulation itself for mechanical system repairs or maintenance without damaging or destroying that insulation, as the seam and joint seals in such products are inherently permanent.

As only the removable jacket itself can be re-used -not the insulation- re-using the jacket may provide some cost savings in maintenance and repair, but this does not impact or improve the longevity an insulation that has been properly vapor-sealed.

To summarize, (1) there are widely-used protective jacket products that provide all the benefits of a removable protective barrier or jacket, save for being reusable, some functioning as low-permeance vapor retarders with their permanently sealed joints, and (2) properly sealed insulation and vapor retarder will be damaged or destroyed when removed, regardless of outer jacket type. For these reasons, it is mis-guided to limit allowable protective jacket products to the removable type.

I would suggest this section verbiage:

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be covered with an outer jacket that is resistant to, and will protect the insulation from, damage or degradation ~~including that~~ caused by sunlight, moisture, ~~and~~ wind, and ~~shall provide shielding from solar radiation that can cause degradation of the material.~~ Adhesive tape shall not be permitted. Adhesives, sealants or tapes used with the jacket shall have the same weather resistance. Removable protective jackets shall not be used to provide the vapor retarder function on below-ambient systems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code text. I do not have data to support this impact statement, but suspect that initial cost of construction could be lower depending on type of assembly that does not use a removable jacket.

Public Comment# 1851

Public Comment 8:

Proponents:

William Ronca, representing K-Flex USA (bill.ronca@kflexusa.com)

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published.

When discussing Freon systems, we are typically talking about AC linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent's reason and justification for this code change, we would offer the following comments:

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. In the event of a jacketing failure, a fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small, confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Many manufacturers and fabricator / distributors now provide pipe insulation with factory applied, fully adhered jacketing. The application of the jacketing under factory controlled conditions allows for a higher quality installation, reduced labor time on a project and reduced installation cost. These popular systems would be eliminated if this code change is approved.

Removable jacketing is not necessary "... to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code". In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language

requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory applied jackets that also provide the required perm rating for refrigerant lines for this application. These jackets are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation and corrosion as required by code*. Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220° F continuous operation), the insulation is also readily reusable (with the exception of maybe 2" on the ends). It should be further noted that many of these factory jackets are clear or translucent, allowing for inspection of the insulation without even having to remove and then reinstall a jacket.

The proponent's cost savings rationale cites an article written by Dr. Saum Nourhamadi, PEx3, Ph.D. CPD, CIPE, CFPE, and LEED AP on the impact and advantages of removable insulation protective covers. While we would be interested in knowing who sponsored this article, the article itself is highly flawed and based on erroneous assumptions. It does not address the basic issues as to whether a removable cover can address the code requirements for moisture protection, corrosion protection and perm rating. It does not weigh the *benefits* of adhered jackets versus the benefits of removable jackets, and the cost savings example is both obsolete due to the introduction of new products and just plain *wrong*. Fully adhered jackets can provide UV, moisture and physical damage protection as well as or better than removable jackets. So the calculations on the cost of damaged insulation become moot as there is no degraded insulation to result in increased energy costs over the life of the equipment *as long as the existing code language is enforced*. In fact, removable jackets are more likely to result in degraded insulation as they cannot provide an effective moisture, insect or mold, algae or bacteria barrier (again, think Velcro). Regardless, the math is incorrect. First, 39.5 million is pretty close to the total population of California. But that does not mean that every man, woman and child in the state of California has their own personal outdoor AC unit with 5 feet of exposed refrigerant line. There are approximately 9.6 million *households* in the state, and not all of them have individual AC units. High rise apartment dwellers certainly don't have them. Even multi-unit dwellings don't all have outdoor AC units. But let's assume that they all have an outdoor AC. Using the same half the *households* premise as used by the author, the savings would be 4.8 million households times \$5 annual savings for a total savings of \$24 million annually. This is a far cry from the proponent's alleged \$975 million. The author is off by a factor of 40.

The proponent's cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. We have already demonstrated that this is not the case in Part I. It is not the case in part II either. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for condensation / corrosion control or perm rating. As a simple example, we can again use the proponent's removable jacket product. The cost to purchase enough jacket to install over a 5 ft. line at a plumbing or HVAC/R supply house is approximately \$40 (actual cost will vary by line size and insulation thickness as well as purchase quantity). It is less on a per foot basis, but the scrap is not really usable. So for a \$5 a year annual savings, the ROI to the homeowner would be 8 years (this does not include cost of installation). But by simply enforcing the existing code language the insulation would not fail, and the homeowner would save that \$40. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is \$0.0962 per kwhr), further extending the ROI.

Based on the above, we urge you to disapprove this code change. We would also urge you to consider the following revisions for the next code cycle:

1. Clarify that adhesive tape cannot be applied *directly to the insulation*. Many jacketing systems utilize tape as an accessory to seal their seams in their systems, and these tape have a long successful history of outdoor use when used for this purpose.
2. Develop or adopt UV resistance standards. Do not leave this to the discretion of the AHJ. It makes it difficult for manufacturers to compete on a national level and it creates an uneven playing field.
3. Develop or adopt damage resistance standards for the same reason as above.
4. Develop or adopt wind resistance standards for removable jacketing.
5. Enforce the existing code language.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2015

Public Comment 9:

Proponents:

Louis Walton, representing VP Sales & Marketing (louis@protocorporation.com)

requests Disapprove

Commenter's Reason: Reference: ICC Proposed code changes:

CE150-19 Part I and CE150-19 Part II

July 23, 2019

Opponent: Louis Walton – Proto Corporation

Requested Action: Disapproval

Reason: The code changes as proposed, are flawed and if implemented will contribute to “in-field failures” to the insulation system.

Currently insulation packages are fully sealed with appropriate vapor barriers to prevent condensation within the insulation system and surrounding areas. These systems also provide exterior protection for abuse and outside use.

If this type of system is not used then the insulation package will be compromised and the following types of issues may occur:

- Icing within the system
- Potential for mold growth
- Reduced Insulating value
- System expansion possibly leading to piping failure

For any below ambient piping, including air conditioning tubing, the insulation system **must be** fully sealed.

As with any pipe maintenance, including air conditioning repairs, appropriate steps must be taken to ensure that the insulation system is returned to its original condition after the repairs are completed. In many cases the insulation and barriers may be reused. This assumes that the worker is properly trained and has the appropriate materials to repair the insulation system and provide the necessary vapor barrier.

- Self-sealing tape (double sided acrylic based)
- Butt strips or sealing tape (acrylic based)
- ASJ jacketing
- PVC or CPVC jacket or strips
- Vapor barrier mastic
- Additional insulation

A barrier, which is designed to be removed, by its very nature is not designed to provide a sealed system. If this type of system is required, by this proposed code change, the use of it will result in field failures. A removable barrier may provide protection for exposure to outdoor, impact resistance, and act as a liquid watershed, but it is not designed to provide a vapor seal. Without this vapor barrier seal the aforementioned issues may occur. This type of failure would be very costly to the end user.

As part of this proposal the justification to use a removable barrier referenced potential energy savings. This reference appears to be incorrect, since all of the air conditioning systems referenced are currently protected using an industry approved insulation system.

If the ICC wants to strengthen the wording of this section of the code perhaps they should consider requiring the individual working on an air conditioning system be trained to remove, re-install or replace the insulation package. This would minimize the potential for field failures and have a minimal cost to the end user.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1892

CE158-19

IECC@: C404.5.2.1

Proposed Change as Submitted

Proponents: Michael Cudahy, PPFA, representing PPFA Plastic Pipe and Fittings Association (mikec@cmservices.com)

2018 International Energy Conservation Code

Revise as follows:

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the "Volume" column in Table ~~C404.5.1~~ ~~C404.5.1~~ or from Table E202.1 of the International Plumbing Code. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Reason: Table E202.1 in the IPC, "Internal Volume of Various Water Distribution Tubing" is well suited for this calculation and should be specifically included as an option in calculations for the section. The table is shown below.

TABLE E202.1 - INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING

OUNCES OF WATER PER FOOT OF TUBE									
Size Nominal, Inch	Copper Type M	Copper Type L	Copper Type K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	Composite ASTM F 1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

For SI: 1 ounce = 0.030 liter.

Bibliography: None

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The addition of the method of calculation is not expected to increase or decrease the cost of construction, it is simply a more accurate method for determining volume.

Staff Analysis: The table referenced is in Appendix E of the IPC.

CE158-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This offers an unnecessary pointer to a code not all jurisdictions use and complicates enforcement. Hopefully the proponent will bring forward a public comment that includes bringing in the referenced table (Vote: 15-0).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

IECC®: C404.5.2.1; IPC®: TABLE C404.5.2.1

Proponents:

Michael Cudahy, Plastic Pipe and Fittings Association, representing PPFA Plastic Pipe and Fittings Association (mikec@cmservnet.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the "Volume" column in Table C404.5.1 or from Table C404.5.2.1. ~~E202.1 of the International Plumbing Code~~. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

2018 International Plumbing Code

**TABLE C404.5.2.1
INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING**

OUNCES OF WATER PER FOOT OF TUBE									
Size Nominal, Inch	Copper Type M	Copper Type L	Copper Type K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	Composite ASTM F 1281	PEX CTS SDR 9
<u>3/8</u>	<u>1.06</u>	<u>0.97</u>	<u>0.84</u>	<u>N/A</u>	<u>1.17</u>	<u>—</u>	<u>0.64</u>	<u>0.63</u>	<u>0.64</u>
<u>1/2</u>	<u>1.69</u>	<u>1.55</u>	<u>1.45</u>	<u>1.25</u>	<u>1.89</u>	<u>1.46</u>	<u>1.18</u>	<u>1.31</u>	<u>1.18</u>
<u>3/4</u>	<u>3.43</u>	<u>3.22</u>	<u>2.90</u>	<u>2.67</u>	<u>3.38</u>	<u>2.74</u>	<u>2.35</u>	<u>3.39</u>	<u>2.35</u>
<u>1</u>	<u>5.81</u>	<u>5.49</u>	<u>5.17</u>	<u>4.43</u>	<u>5.53</u>	<u>4.57</u>	<u>3.91</u>	<u>5.56</u>	<u>3.91</u>
<u>1 1/4</u>	<u>8.70</u>	<u>8.36</u>	<u>8.09</u>	<u>6.61</u>	<u>9.66</u>	<u>8.24</u>	<u>5.81</u>	<u>8.49</u>	<u>5.81</u>
<u>1 1/2</u>	<u>12.18</u>	<u>11.83</u>	<u>11.45</u>	<u>9.22</u>	<u>13.20</u>	<u>11.38</u>	<u>8.09</u>	<u>13.88</u>	<u>8.09</u>
<u>2</u>	<u>21.08</u>	<u>20.58</u>	<u>20.04</u>	<u>15.79</u>	<u>21.88</u>	<u>19.11</u>	<u>13.86</u>	<u>21.48</u>	<u>13.86</u>

For SI: 1 ounce = 0.030 liter.

Commenter's Reason: As asked by the committee, I offer a public comment to add the volume table directly in this modification.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal only refers to a table of pipe volume and will not change the costs of construction.

Staff Analysis: The new Table C404.X is TABLE E202.1 - INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING of the IPC

Public Comment# 1529

CE159-19 Part I

IECC@: C404.6.1, C404.6.1.1

Proposed Change as Submitted

Proponents: Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C404.6.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).

~~**C404.7 C404.6.1.1 Demand recirculation controls.**~~ Demand recirculation water systems shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
- ~~2. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).~~

Reason:

Part I -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section C404.7 - 'Demand recirculation water systems' is moved and renumbered as a subsection to C404.6.1 - 'Circulation systems' because a demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section C404.6.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Part II -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section R403.5.2 - 'Demand recirculation water systems' is moved and renumbered as a subsection to R403.5.1.1 - 'Circulation systems' because demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section R403.5.1.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change does not add any new requirements.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: This needs to be fixed in the public comment period, including bringing back the modification (Vote 8-7).

Assembly Action:

None

CE159-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: C404.6.1, C404.6.1.1

Proponents:

Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C404.6.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall ~~start the pump based on the identification of a demand for hot water within the occupancy. The controls shall~~ automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).

C404.6.1.1 Demand recirculation controls. Demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance. ~~comply with both of the following:~~

- ~~1- The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~

Commenter's Reason: This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section R403.5.2 (Demand recirculation water systems) is moved and renumbered as a subsection to R403.5.1.1 (Circulation systems) because demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of (Demand recirculation water systems) is relocated to the body of section R403.5.1.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. The code change is also consistent with the committee approval of CE22-19, Parts I and II for revising the definition of "Demand Recirculation Water System". These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change only clarifies existing provisions and does not add new requirements.

CE159-19 Part II

IECC: R403.5.1.1 (IRC N1103.5.1.1), R403.5.2 (IRC N1103.5.2)

Proposed Change as Submitted

Proponents: Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

2018 International Energy Conservation Code

Revise as follows:

R403.5.1.1 (IRC N1103.5.1.1) Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).

~~R403.5.2 (IRC N1103.5.2)~~ R403.5.1.1.1 (IRC N1103.5.1.1.1) Demand recirculation water systems. Demand recirculation water systems shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
2. ~~The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).~~

Reason:

Part I -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section C404.7 - 'Demand recirculation water systems' is moved and renumbered as a subsection to C404.6.1 - 'Circulation systems' because a demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section C404.6.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Part II -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section R403.5.2 - 'Demand recirculation water systems' is moved and renumbered as a subsection to R403.5.1.1 - 'Circulation systems' because demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section R403.5.1.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change does not add any new requirements.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: It provides a needed split into two separate sections (Vote: 11-0).

Assembly Action:

None

CE159-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.5.1.1 (IRC N1103.5.1.1), R403.5.1.1.1 (IRC N1103.5.1.1.1)

Proponents:

Anthony Floyd, representing City of Scottsdale (afloyd@scottsdaleaz.gov); David Collins (sehpcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.5.1.1 (IRC N1103.5.1.1) Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall ~~start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).~~

R403.5.1.1.1 (IRC N1103.5.1.1.1) Demand recirculation water systems. Demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~comply with both of the following:~~

- ~~1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~

~~2. -~~

Commenter's Reason: This public comment removes the redundancy of language in Section R403.5.1.1 (Circulation systems) that pertains to controls based on the identification of a demand. This demand control provision is already covered in Section R403.5.1.1.1 for Demand recirculation water systems. Secondly, the demand control provision under Section R403.5.1.1.1 is consolidated into one sentence of the charging section. Subsection item #1 is no longer needed.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. The public comment is also consistent with the committee approval of CE22-19, Parts I and II for revising the definition of "Demand Recirculation Water System". These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This public comment on only further clarifies the proposal, both of which do not change the existing provisions and thus, does not impact the costs of contraction.

Public Comment# 1393

CE160-19 Part I

IECC: Part I: C404.9.1, C404.9.3, C404.10

IECC Part II: R403.10 (N1103.10), R403.10.2 (N1103.10.2), R403.10.3(N1103.10.3), R403.12 (N1103.12)

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

C404.9 Energy consumption of pools and permanent spas (Mandatory). The energy consumption of pools and permanent spas shall be controlled by the requirements in Sections C404.9.1 through C404.9.3.

Revise as follows:

C404.9.1 Heaters. The electric power to ~~all~~ heaters shall be controlled by ~~an~~ a readily accessible on-off switch that is an integral part of the heater, mounted on the exterior of the heater ~~;~~ or external to and within 3 feet (914 mm) of the heater ~~in a location with ready access~~. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

C404.9.2 Time switches. Time switches or other control methods that can automatically turn off and on heaters and pump motors according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

Revise as follows:

C404.9.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than ~~75~~ 70 percent of the energy for heating, computed over an operating season ~~of not fewer than 3 calendar months~~, is ~~from site-recovered energy such as~~ from a heat pump or ~~on-site renewable solar energy system source~~, covers or other vapor-retardant means shall not be required.

C404.10 Energy consumption of portable ~~Portable~~ spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP 14.

Reason: This proposal aligns the energy efficiency provisions of the IECC for commercial pools, spas and portable spas (hot tubs) with those found in the 2018 International Swimming Pool & Spa Code. A similar proposal has been submitted to ensure IECC residential provisions are also aligned with the ISPSC pool & spa energy efficiency provisions found within Section 303. Without this proposal a jurisdiction who adopts both the IECC and ISPSC will have conflicting code requirements addressing covers for outdoor heated pools and outdoor permanent spas.

The original intent of the exception from the vapor retardant pool or outdoor permanent spa cover requirement found in section C404.9.3 is for when the owner of the facility chooses either a solar pool heater (on site renewable energy system) or an air-source swimming pool heat pump (site-recovered energy). However, the language that is currently in this section of the IECC uses the term "site-recovered energy" and provides a swimming pool heat pump as an example, but this was done without a proper understanding by the pool & spa industry that the "site-recovered energy" term is not defined to include an air-source swimming pool heat pump. In fact, there is no swimming pool heat pump on the market that would meet the ASHRAE 90.1 definition of "site-recovered energy" - if the industry had understood that from the beginning, we clearly would not have used those words when first providing for this exception.

An air-source swimming pool heat pump transfers heat from the air to the pool (or permanent spa) and is a more efficient way to heat a pool or outdoor permanent spa (the latter of which typically uses gas) over other types of heaters that exist. The definition of "site-recovered energy" in ASHRAE 90.1-16 is "waste *energy* recovered at the *building* site that is used to offset consumption of purchased *fuel* or electrical *energy* supplies."

This exception has been used since it was included in the code, but they are when a consumer utilizes an air-source heat pump or a solar energy source, as originally intended by the exception. Therefore, this proposal is simply eliminating a term to clarify the original intent that if a pool or permanent spa utilizes an air-source heat pump or solar pool heating system for more than 70% of the energy used in heating the pool or permanent

spa, it is exempt from the vapor retardant cover requirement.

To leave the code as it currently is written means the exception will either continue to be enforced incorrectly, as we know it has been or it will become pointless if enforced correctly since no swimming pool heating product exists that would meet the definition of “site-recovered energy”. This may in turn encourage less energy efficient ways to heat a pool or spa – the reality is after the pool or spa is installed and the final inspection has occurred, there is no way to ensure a cover is being put back on after every use; therefore, encouraging use of more energy efficient heating systems by providing an exception from the vapor-retardant cover provides a greater chance of energy savings.

The proposed change also aligns the cover exception with the ISPSC by using a 70% threshold computed over an operation season – there is no minimum operating season in the ISPSC due to the fact depending on the part of the country, an operating season can be from as little as a few months to an entire year.

The remaining code proposal language is simply cleanup to reflect consistent verbiage used between the two I-codes, because the pool & spa energy efficiency language is not completely consistent when comparing the IECC to the ISPSC. Further, within the IECC the commercial and residential provisions slightly differ as well (for example site-recovered energy is not included in the IECC residential provisions). Although the remaining differences are minor and may not affect the intent, eliminating differences do lessen the chance of interpretation errors.

By adopting this code change, a jurisdiction that adopts both the ISPSC and IECC, which is increasingly more likely and already exists in many cases (over 20 states and 160 localities have adopted the ISPSC), will not be left with conflicting code requirements. Rather, they will co-exist by providing consistent requirements that follow the original intent.

Bibliography: 2018 ISPSC, Section 303; 2018 IECC, Section R403.10; and ASHRAE 90.1, 2016 edition

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change should not affect the cost of construction but for any costs associated with differing provisions found within the current ISPSC and IECC editions, if the change is not adopted. The proposal simply ensures the IECC has consistent energy efficiency requirements for residential pools and spas from what is found in the ISPSC.

CE160-19 Part I

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The purpose was to align, but then there was a modification and a rollback, it is not advancing energy conservation. It's eliminating minimum time factor (Vote:10-5).

Assembly Action:

None

CE160-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: C404.9.3, C404.10

Proponents:

Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

C404.9.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than 75 percent of the energy for heating, computed over an operating season of not fewer than 3 calendar months, is from ~~site-recovered energy such as from a heat pump or an~~ on-site renewable energy system, covers or other vapor-retardant means shall not be required.

C404.10 ~~Energy consumption of p~~ Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP 14.

Commenter's Reason: The original proposal and the intent of this public comment was to align the energy efficiency provisions found in the IECC with the ISPSC, so there is no conflicting code requirements or issues of interpretation when verbiage is not the same.

This public comment replaces the original proposal in order to:

1. Revert back to the current "ready access" verbiage in C404.9.1 for heaters to follow the I-code elimination of the use of readily accessible or accessible for only when addressing it in regards to persons with disabilities and not to equipment. (This will now require a fix in the ISPSC to proper align.)
2. In the exception language for pool covers, it reverts back to 75% of the energy for heating, computed over an operating season of not fewer than 3 calendar months, but it cleans up the rest of the language to follow terminology and wording in the ISPSC and IECC-R proposal. (Additional tweaks will then need to be made to the ISPSC).

This public comment is being put forth as a two step process to get the language in the IECC-R, IECC-C and ISPSC to align. If public comments for the IECC-R and this one for the IECC-C go through, the second step will be alignment in the ISPSC to the cover provisions and removal of the readily accessible verbiage.

The goal is alignment to limit confusion in the field by inspectors and contractors. This public comment also ensures the water and energy conservation provisions are maintained, with no rollback, simply consistent terminology.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal and comment are simply trying to align the codes and should not increase or decrease the cost of construction but for any issues that could arise if the two codes are not aligned.

Public Comment# 2033

CE160-19 Part II

IECC: R403.10 (IRC N1103.10), R403.10.1 (IRC N1103.10.1), R403.10.3 (IRC N1103.10.3), R403.12 (IRC N1103.12)

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

2018 International Energy Conservation Code

Revise as follows:

R403.10 (IRC N1103.10) Pools Energy consumption of pools and permanent spa energy consumption spas (Mandatory). The energy consumption of pools and permanent spas shall be controlled by the requirements in accordance with Sections R403.10.1 through R403.10.3.

R403.10.1 (IRC N1103.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater, mounted on the exterior of the heater or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

R403.10.2 (IRC N1103.10.2) Time switches. Time switches or other control methods that can automatically turn off and on heaters and pump motors according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

R403.10.3 (IRC N1103.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than ~~75~~ 70 percent of the energy for heating, computed over an operation season of ~~not less than three calendar months~~, is from a heat pump or an on-site renewable solar energy system source, covers or other vapor-retardant means shall not be required.

R403.11 (IRC N1103.11) Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

R403.12 (IRC N1103.12) Residential pools and permanent residential spas- spas (Mandatory). ~~Residential~~ The energy consumption of residential swimming pools and permanent residential spas ~~that are accessory to detached one- and two- family dwellings and townhouses three stories or less in height above grade plane and that are available only to the household and its guests~~ shall be controlled in accordance with the requirements of APSP 15.

Reason: This proposal aligns the energy efficiency provisions of the IECC for commercial pools, spas and portable spas (hot tubs) with those found in the 2018 International Swimming Pool & Spa Code. A similar proposal has been submitted to ensure IECC residential provisions are also aligned with the ISPSC pool & spa energy efficiency provisions found within Section 303. Without this proposal a jurisdiction who adopts both the IECC and ISPSC will have conflicting code requirements addressing covers for outdoor heated pools and outdoor permanent spas.

The original intent of the exception from the vapor retardant pool or outdoor permanent spa cover requirement found in section C404.9.3 is for when the owner of the facility chooses either a solar pool heater (on site renewable energy system) or an air-source swimming pool heat pump (site-recovered energy). However, the language that is currently in this section of the IECC uses the term "site-recovered energy" and provides a swimming pool heat pump as an example, but this was done without a proper understanding by the pool & spa industry that the "site-recovered energy" term is not defined to include an air-source swimming pool heat pump. In fact, there is no swimming pool heat pump on the market that would meet the ASHRAE 90.1 definition of "site-recovered energy" - if the industry had understood that from the beginning, we clearly would not have used those words when first providing for this exception.

An air-source swimming pool heat pump transfers heat from the air to the pool (or permanent spa) and is a more efficient way to heat a pool or outdoor permanent spa (the latter of which typically uses gas) over other types of heaters that exist. The definition of "site-recovered energy" in ASHRAE 90.1-16 is "waste *energy* recovered at the *building* site that is used to offset consumption of purchased *fuel* or electrical *energy* supplies."

This exception has been used since it was included in the code, but they are when a consumer utilizes an air-source heat pump or a solar energy source, as originally intended by the exception. Therefore, this proposal is simply eliminating a term to clarify the original intent that if a pool or permanent spa utilizes an air-source heat pump or solar pool heating system for more than 70% of the energy used in heating the pool or permanent spa, it is exempt from the vapor retardant cover requirement.

To leave the code as it currently is written means the exception will either continue to be enforced incorrectly, as we know it has been or it will become pointless if enforced correctly since no swimming pool heating product exists that would meet the definition of "site-recovered energy". This

may in turn encourage less energy efficient ways to heat a pool or spa – the reality is after the pool or spa is installed and the final inspection has occurred, there is no way to ensure a cover is being put back on after every use; therefore, encouraging use of more energy efficient heating systems by providing an exception from the vapor-retardant cover provides a greater chance of energy savings.

The proposed change also aligns the cover exception with the ISPSC by using a 70% threshold computed over an operation season – there is no minimum operating season in the ISPSC due to the fact depending on the part of the country, an operating season can be from as little as a few months to an entire year.

The remaining code proposal language is simply cleanup to reflect consistent verbiage used between the two I-codes, because the pool & spa energy efficiency language is not completely consistent when comparing the IECC to the ISPSC. Further, within the IECC the commercial and residential provisions slightly differ as well (for example site-recovered energy is not included in the IECC residential provisions). Although the remaining differences are minor and may not affect the intent, eliminating differences do lessen the chance of interpretation errors.

By adopting this code change, a jurisdiction that adopts both the ISPSC and IECC, which is increasingly more likely and already exists in many cases (over 20 states and 160 localities have adopted the ISPSC), will not be left with conflicting code requirements. Rather, they will co-exist by providing consistent requirements that follow the original intent.

Bibliography: 2018 ISPSC, Section 303; 2018 IECC, Section R403.10; and ASHRAE 90.1, 2016 edition

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The code change should not affect the cost of construction but for any costs associated with differing provisions found within the current ISPSC and IECC editions, if the change is not adopted. The proposal simply ensures the IECC has consistent energy efficiency requirements for residential pools and spas from what is found in the ISPSC.

CE160-19 Part II

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

R403.10.3 (IRC N1103.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than 70 percent of the energy for heating, computed over an operation season, is from a heat pump or an on-site renewable energy system ~~solar energy source~~, covers or other vapor-retardant means shall not be required.

Committee Reason: This brings the ISPS and the IECC into alignment. The modifications restore language to be inclusive of all renewables (Vote 11-0).

Assembly Action:

None

CE160-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: R403.10.1 (IRC N1103.10.1), R403.10.3 (IRC N1103.10.3)

Proponents:

Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R403.10.1 (IRC N1103.10.1) Heaters. The electric power to heaters shall be controlled by an ~~readily accessible~~ on-off switch that is an integral part of the heater, mounted on the exterior of the heater or external to and within 3 feet (914 mm) of the heater in a location with ready access. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

R403.10.3 (IRC N1103.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than ~~70-75~~ percent of the energy for heating, computed over an operation season of not fewer than 3 calendar months, is from a heat pump or an *on-site renewable energy* system, covers or other vapor-retardant means shall not be required.

Commenter's Reason: The original proposal's intent was to align the energy efficiency provisions found in the IECC with the ISPSC, so there is no conflicting code requirements or issues of interpretation when verbiage is not the same.

This public comment builds upon the original proposal by addressing two areas of concern:

1. Addresses the "readily accessible" verbiage for consistency with what is in C404.9.1 that provides the same pool heater requirements but with the new "ready access" terminology now being used across the I-codes.
2. Addresses concerns in the cover exception to align with the C404.9.3 that provides the same for commercial pools.

If the original proposal with these additional public comment modifications are made, most of the language in the ISPSC and IECC will then align. Step 2 will be putting forth a proposal for the ISPSC that now will make changes to the "readily accessible" verbiage and pool cover provisions to align with the IECC.

It is critical these two codes align to limit confusion in the field by inspectors and contractors. This is step one to ensure that occurs.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal and comment are simply trying to align the codes and should not increase or decrease the cost of construction but for any issues that could arise if the two codes are not aligned.

Public Comment# 2024

Public Comment 2:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: I agree that these provisions have diverged from the provisions of the ISPC. These provisions are energy driven provisions and should reside in the IECC not the ISPC. My suggestion to the proponent is to take the provisions in the ISPC and just reference the sections of IECC for these particular provisions. In cycles past there have been pool and spa provisions in the various different I-codes, but when the ISPC was created these provisions were removed and the ISPC was referenced for the requirements. The same concept should be used with these energy driven provisions. ISPC should reference the IECC for the energy driven requirements. That is the purpose of the I-codes family is each code has it's specialty. To assist with keeping all requirements correlated is by not placing duplicate provisions in various codes, but to reference the specialty code it should reside in.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1796

CE162-19

IECC@: C405.1, C405.1.1 (New), C405.1.2 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

C405.1 General (Mandatory). ~~This section covers lighting~~ Lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption shall comply with this section.

~~Dwelling units within multifamily buildings shall comply with Section R404.1. All other dwelling units shall comply with Section R404.1, or with Sections C405.2.4 and C405.3. Sleeping units shall comply with Section C405.2.4, and with Section R404.1 or C405.3. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2.~~

Add new text as follows:

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.4 and C405.3.

C405.1.2 Lighting for refrigerated applications. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2.

Reason: The current language refers lighting in dwelling units to the lighting requirements in the residential section. The referenced residential code sections include a requirement that 90% of the lighting be provided by "high efficacy lamps." There are a handful of issues with the existing code requirements:

1. The definition of "high efficacy lamps" has not been updated to reflect the changes in the market due to increased federal minimums and greater availability/affordability of LED lighting. As a result the code has actually become less stringent as the baseline for lighting equipment is raised.
2. The categories in the definition of "high efficacy lamps" in the residential code is an artifact of incandescent and early compact fluorescent lamp wattages. As lamps have gotten more efficient, the higher wattage categories have become less meaningful. Even a "100W equivalent" LED lamp and "60W equivalent" CFL lamps generally uses 15W or less, which is the bottom category in the existing definition. As a result, the categories have become largely meaningless.
3. The definition is for high efficacy lamps. However, with the proliferation of LED lighting, the market is increasingly utilizing luminaires with integrated LEDs, which are not really lamps. This prevents this high-efficiency lighting solution from being used to meet the high efficacy requirement.

This proposal solves these problems by replacing the reference to the residential lamp efficacy requirements with built-in lighting requirements. Like the existing lighting requirement, this proposal would require that 90% of the lighting be provided by higher performance lighting, but it replaces the reference to "high efficacy lamps" with a built-in efficacy requirement. This requirement establishes minimums for both lamps and luminaires so that it is relevant to the current lighting market without the wattage bins that are no longer relevant to current technologies. The efficacy levels are widely available and are low enough that products with a wide array of color temperatures and CRIs can meet the requirement, providing lighting designers and customers with flexibility.

The proposal also structures the section for greater clarity. Requirements for dwelling unit lighting and refrigerated application have been somewhat shoe-horned into C405.1, leaving the section bloated and without focus. This proposal breaks the requirements for dwelling unit lighting and refrigerated applications into standalone sub-sections for greater clarity.

When modeled against IECC-2015 using the mid-rise and high-rise prototypes developed by Pacific Northwest National Lab for code determination studies, whole-building energy savings ranged from 0.1-0.5% and whole-building electricity savings ranged from 5.3-6.5%. While the 2018 IECC is not exactly the same baseline as 2015, the lighting requirements did not change and these results give a reasonable approximation of savings. Based on U.S. DOE studies, the cost savings by replacing all of the CFLs with higher efficacy LED lighting saves approximately \$6 per year per dwelling unit in overall regulated energy costs.

Cost Impact: The code change proposal will increase the cost of construction

This change could potentially increase the cost of construction because it requires higher efficacy lighting (lamps and/or fixtures), which will likely eliminate some lower-end CFL options and/or push builders to newer LED technologies. However, the cost of LEDs has been steadily declining over the last several years and is expected to continue to decline. Based on an analysis by the U.S. Department of Energy's Building Energy Codes Program conducted during the 2018 IECC Code Development cycle, the estimated and projected prices for LEDs were \$4.84 per lamp compared to

CFLs at \$3.10 per lamp. However, the rapid expansion of the LED lighting market has changed the economics. A spot check of Home Depot in early 2019 showed that a warm white, 60W equivalent A-lamp is as low as \$1.24 for both CFL and LED when purchased in packs. And, LEDs are actually cheaper than CFLs at some sources. At 1000bulbs.com, an online retailer, the same lamps are \$1.79/bulb for CFL and \$0.99 for LED. Therefore, this code change may actually reduce the cost of construction.

CE162-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C405.1 General (Mandatory). Lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption shall comply with this section. *Sleeping units shall comply with Section C405.2.4, and with Section C505.1.1 or C405.3.*

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting, *excluding kitchen appliance lighting,* serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.4 and C405.3.

C405.1.2 Lighting for refrigerated applications. ~~Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2.~~

Committee Reason: The proposal enhances efficacy units for R1 and R2. The modifications correct the pointer, provide consistency with actions on CE144 and CE149 and exempts the particular light in the kitchen that the stakeholders agreed was necessary (Vote: 14-1).

Assembly Action:

None

CE162-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C405.1.1 (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting, excluding kitchen appliance lighting, serving dwelling units shall be provided by lamps with an *initial* efficacy of not less than ~~65~~ *61* lm/W or luminaires with an *initial* efficacy of not less than ~~45~~ *50* lm/W, or shall comply with Sections C405.2.4 and C405.3.

Commenter's Reason: These changes are based on the most recent Energy Star specifications for lamps and luminaires. By aligning with the Energy Star values, it will help with compliance and enforcement.

-For the Energy Star ratings, the minimum lamp efficiency (efficacy rating) is based on their *initial* light output, not their mean output.

-For lamps, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of lamp (omnidirectional, directional, or decorative) *and* their Color Rendering Index (CRI) values (*≥* 90 CRI or *<* 90 CRI). The minimum required initial values range from 61 lumens/Watt to 80 lumens/Watt. Changing the value from 65 to 61 will help align with the latest Energy Star specifications.

-For luminaires, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of fixture (e.g., cove, downlight, accent, outdoor, etc.). The minimum required initial values range from 50 lumens/Watt to 70 lumens/Watt. Changing the value from 45 to 50 will help align with the latest Energy Star specifications and increase efficiency.

Bibliography: ENERGY STAR Lamps Final Specification Version 2.1, June 20, 2017, Table 9.1, available at <https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V2.1%20Final%20Specification.pdf>
ENERGY STAR Luminaires Final Specification Version 2.1, March 15, 2018, Table 9.2, available at <https://www.energystar.gov/sites/default/files/Luminaires%20V2.1%20Spec%20Final%20with%20Partner%20Commitments.pdf>

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction Lamps and luminaires that have higher efficacies are usually more expensive than standard lamps and luminaires.

Public Comment# 1291

CE181-19

IECC@: C405.2.2.2

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Revise as follows:

C405.2.2.2 Light-reduction controls. Spaces required to have light-reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load by not less than 50 percent in a reasonably uniform illumination pattern ~~by not less than 50 percent, with an intermediate step in addition to full on or off, or with continuous dimming control.~~ Lighting reduction shall be achieved by one of the following or another *approved* method:

1. Controlling all lamps or luminaires.
2. Dual switching of alternate rows of luminaires, alternate luminaires or alternate lamps.
3. Switching the middle lamp luminaires independently of the outer lamps.
4. Switching each luminaire or each lamp.

Exception: Light reduction controls are not required in *daylight zones* with *daylight responsive controls* complying with Section C405.2.3.

Reason: Revising this language will:

1. Increase energy efficiency
2. Reduce inconsistency and confusion with light-reduction control requirements
3. Increase code interpretation, application and enforcement
4. Correct an unintended loophole

The ability to reduce light level either by lighting load on/off switch control or by continuous dimming, provides energy savings as well as lighting adjustability benefits for the occupant. The intent of the provision is to allow space occupants to manually reduce their lighting level by at least 50% of lighting load for personal preference, to avoid glare or simply because full lighting levels is not needed in the space. The light-reduction control requirement has a loophole which allows provision compliance without meeting the intent. Manual lighting controls which turns lighting all the way off, can be interpreted as a reduction of the lighting load of "not less than 50 percent." The way the language is written, full shut off would comply with the provision, but would not meet the intent of the code.

The proposed language would indicate light-reduction control is an intermediate step, in addition to lighting full on and full off control steps, typically provided by manual control requirements. This language eliminates the present loop hole allowing no light reduction control, as the code intends just the opposite. The proposed language also clarifies that continuous dimming would comply with the control requirement while providing further adjustability benefits to the space occupants.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This is an editorial change to clarify the code's intent. It will improve compliance and consistency for energy efficient control of lighting.

CE181-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The accomplishes an intermediate step for noncontinuous lighting with reasonable coverage (Vote: 8-7).

Assembly Action:

None

CE181-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.2.2.2

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.2.2.2 Light-reduction controls. Spaces required to have light-reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load ~~by not less than 50 percent~~ in a reasonably uniform illumination pattern ~~with an intermediate step in addition to full on or off, or with continuous dimming control.~~ Lighting reduction shall be achieved by using one of the following or another *approved* method:

1. ~~Controlling all lamps or luminaires~~ Continuous dimming of all luminaires from full output to less than 20 percent of full power.
2. ~~Dual switching of alternate rows of luminaires, alternate luminaires or alternate lamps~~ Switching all luminaires to a reduced output of not less than 30 percent, and not more than 70 percent of full power.
3. Switching alternate luminaires or alternate rows of luminaires to achieve a reduced output of not less than 30 percent, and not more than 70 percent of full power ~~the middle lamp luminaires independently of the outer lamps.~~
4. ~~Switching each luminaire or each lamp.~~

Exception: ~~Light reduction controls are not required in daylight zones with daylight responsive controls complying with Section C405.2.3.~~

Commenter's Reason: This public comment and modification responds to the Committee Action Hearing guidance by coordinating proposals CE179-19 and CE181-19, and resolving the dated lighting control language by accomplishing the following:

- Making the code language technology neutral
- Removing archaic terminology that only applies to fluorescent lighting
- Assuring lighting uniformity when space lighting levels are reduced
- Incorporating the word "dimming", clarifying it as an acceptable Light Reduction Control method (as currently written, unclear to some practitioners)
- Fixing a gap in the code language by clarifying that Light Reduction Control is an intermediate lighting control step between On and Off
- Maintaining light controllability for occupants in spaces with daylight responsive zones
- Creating language that is clear and enforceable by building officials without the burden of additional requirements. In fact, it reduces the requirements and exceptions that need to be verified.

These modifications make the code understandable to read, clear to implement, up to date with technology and easy to enforce by building officials.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This code change proposal and public comment modifications modernizes the language to fit with today's lighting technology and clarifies acceptable lighting control methods used more predominantly in today's buildings without increasing the cost of construction.

Public Comment# 1414

CE185-19

IECC@: C405.2.3.1

Proposed Change as Submitted

Proponents: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com); Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

2018 International Energy Conservation Code

Revise as follows:

C405.2.3.1 Daylight-responsive control function. Where required, daylight-responsive controls shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in toplit zones in accordance with Section C405.2.3.3 shall be controlled independently of lights in sidelit zones in accordance with Section C405.2.3.2.
2. Daylight responsive controls within each space shall be configured so that they can be calibrated from within that space by authorized personnel.
3. Calibration mechanisms shall be in a location with ready access.
4. ~~Where located in offices, classrooms, laboratories and library reading rooms, daylight~~ Daylight responsive controls shall dim lights continuously from full light output to 15 percent of full light output or lower.
5. Daylight responsive controls shall be configured to completely shut off all controlled lights.
6. Lights in sidelit zones in accordance with Section C405.2.3.2 facing different cardinal orientations [within 45 degrees (0.79 rad) of due north, east, south, west] shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

Reason: Currently daylight responsive controls are only required to dim lights in offices, classrooms, laboratories, and library reading rooms. In all other spaces, daylight responsive controls are only required to switch lights off.

Switching lights off leaves a lot of potential energy savings "on the table", as the daylight responsive controls will only save energy when there is sufficient daylight to entirely replace the electric lights. In some installations this may never happen. By contrast, when dimming is required, there will be energy savings whenever there is any useful daylight in the space. Making this change will result in additional energy savings in literally every installation.

This change is feasible today because of the incredibly fast penetration of LED technology into the marketplace. LED luminaires are already almost universally dimmable, and taking advantage of this capability will usually mean running a couple of additional wires. This cost is trivial compared to the cost of installing and commissioning the control systems to begin with.

Functionally, we know that dimming is preferred by building occupants, since the change in light levels is less noticeable, so this will also qualitatively improve the lighting, and increase user acceptance of the controls.

Cost Impact: The code change proposal will increase the cost of construction

Dimming is already the preferred strategy for daylight responsive control of interior lights, and is almost universally used in new construction. With increasing penetration of LED technology in coming years, the cost increase compared to switching will be trivial. But still, there will be some additional cost.

CE185-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: This is an important update and there is an alternative compliance path for lower efficacy lights. The code should lead, not follow (Vote: 10-5).

Assembly Action:

None

CE185-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This change will prevent the use of high-efficiency lamps, such as metal halide and high-pressure sodium, from being used for all daylighting applications (such as high-bay applications), not just those in offices, classrooms, laboratories and library reading rooms as currently required.

As shown in NEMA publication, high-efficiency HID lamps (such as metal halide) can only be safely dimmed to 50-70% of their rated lamp wattage. With the requirement to dim to 15% of full light output or lower, it effectively bans the use of a high-efficiency technology that is still on the market.

A minimum energy code should not have language that prevents the use of a high-efficiency technology. This change should be disapproved, in favor of other proposals (such as CE-188) that will save energy and are more technology neutral.

Bibliography: NEMA LSD 14-2012 (R2019) *Guidelines on the Application of Dimming to High-Intensity Discharge Lamps*, June 21, 2019

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will not change the current code.

Public Comment# 1292

Proposed Change as Submitted

Proponents: Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

2018 International Energy Conservation Code

Revise as follows:

C405.2.3.1 Daylight responsive control function. Where required, daylight-responsive *controls* shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in *toplit* zones in accordance with Section C405.2.3.3 shall be controlled independently of lights in *sidelit* zones in accordance with Section C405.2.3.2.
2. *Daylight responsive controls* within each space shall be configured so that they can be calibrated from within that space by authorized personnel.
3. Calibration mechanisms shall be in a location with *ready access*.
4. Where located in offices, classrooms, laboratories and library reading rooms, *daylight responsive controls* shall dim lights continuously from full light output to 15 percent of full light output or lower. In all other spaces, *daylight responsive controls* shall dim lights continuously from full output to 20 percent of full light output or reduce power to between 30 and 70 percent of full power by controlling all luminaires to a reduced light output or by switching alternate luminaires.
5. *Daylight responsive controls* shall be configured to completely shut off all controlled lights.
6. Lights in *sidelit* zones in accordance with Section C405.2.3.2 facing different cardinal orientations [within 45 degrees (0.79 rad) of due north, east, south, west] shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

Reason: Currently the IECC daylight-responsive controls requirements includes dimming for a few spaces and for all other spaces, a minimally compliant daylight-responsive control only need turn the lights off under full daylight availability. For light sources that are difficult to dim continuously (such as HID), the savings associated with daylight controls is substantially less than it could be with multi-level controls. Multi-level controls increase energy savings by approximately 50% as compared to on/off controls. This is documented in the CASE sidelighting and skylighting reports. By allowing other forms of multi-level controls besides continuous dimming, the code is being technology neutral and accommodating light sources that are hard to dim. Requiring multi-levels switching or continuous dimming for daylighting controls is aligned with most other energy codes in the United States including ASHRAE 90.1.

Bibliography:

CASE (Codes and Standards Enhancement Updates to Title 24 Treatment of Skylights. 2005 California Title 24 Building Energy Efficiency Standards. May 2002.

https://mchughenergy.com/papers/2002-05-17_SKY-LT_PROP_T24.pdf

CASE (Codes and Standards Enhancement) Draft Report Sidelighting – Daylighting Requirements for Sidelit Areas near Windows. 2008 California Title 24 Building Energy Efficiency Standards July 6, 2006 https://mchughenergy.com/papers/2006-07-07_DRAFT_SIDELIGHTING_REP.pdf

HMG/PNNL 90.1 Skylighting Requirements Code Change Proposal, Submitted to ASHRAE 90.1 Standard Envelope and Lighting Subcommittees June 2008.

https://mchughenergy.com/papers/PNNL_Daylight901_pt4.pdf

Cost Impact: The code change proposal will increase the cost of construction

As documented in the HMG/PNNL (2008) report “As a result of discussion with the ASHRAE 90.1 Lighting Subcommittee, the following variable and fixed costs were associated with dimming and switching controls systems. For switching control systems the additional circuiting costs associated with bi-level switching is \$0.108/sf...” In comparison for warehouse spaces, the added life cycle savings from using multi-level controls instead of On/Off controls are around \$0.25/sf (CASE 2002) and in sidelit spaces the life cycle savings are around \$0.50/sf. (CASE 2006). Thus the added costs are well outweighed by the life cycle savings.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on proponent's request for disapproval and committee action on CE185 (Vote 15-0).

Assembly Action:

None

CE188-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

requests As Submitted

Commenter's Reason: The rationale for requiring multi-level controls is the same as it was back in 2002 when the "Updates to Title 24 Treatment of Skylights" was commissioned to consider, multi-level photocontrol requirements for skylit daylight spaces. It is hard to find more recent studies comparing on/off controls with multilevel controls as the de factor standard for daylighting controls is multi-level switching or continuous dimming. Both ASHRAE 90.1 and California's Title 24 energy codes have required multi-level switching or continuous dimming daylighting controls for around a decade. With the rapid advance of LED lighting, the balance has shifted to most daylighting controls being continuous dimming. Figure 4 illustrates the fraction of power versus fraction of light curves for the various control types. Of key interest is to compare the control strategy between "ON/OFF" controls and "2 LEVEL + OFF Switching" controls. The first two columns of life cycle energy cost savings data in Table 6 are for "ON/OFF" controls and "2 LEVEL + OFF Switching" controls. From this table, over the range of skylight to floor ratios (SFRs) from 1.9% to 3.9% the added energy and life cycle cost savings from on/off controls to two level plus off controls is between 25% and 104% for warehouses and greater than 109% for retail occupancies. It should be noted that the continuous dimming savings are greater than what is listed in Table 6, as the current continuous dimming requirements for offices, classrooms, laboratories and library reading rooms are dimming plus off, whereas the analysis results shown in Figure 6 are continuous dimming to 10% light output without an OFF step.

The fixed rate economic analysis was present valued \$1.37/kWh over a 15 year period at a 3% real discount rate. This is the same as 11.5 cents per kWh on an annualized basis. In general the life cycle cost savings was in excess of \$0.30/sf in warehouses and in excess of \$1.00/sf in retail spaces. With lower LPDs the savings would be approximately half of this amount on a per square foot basis. However many of the light sources used to justify lower LPDs are LED and often have dimming with little to none cost premium.

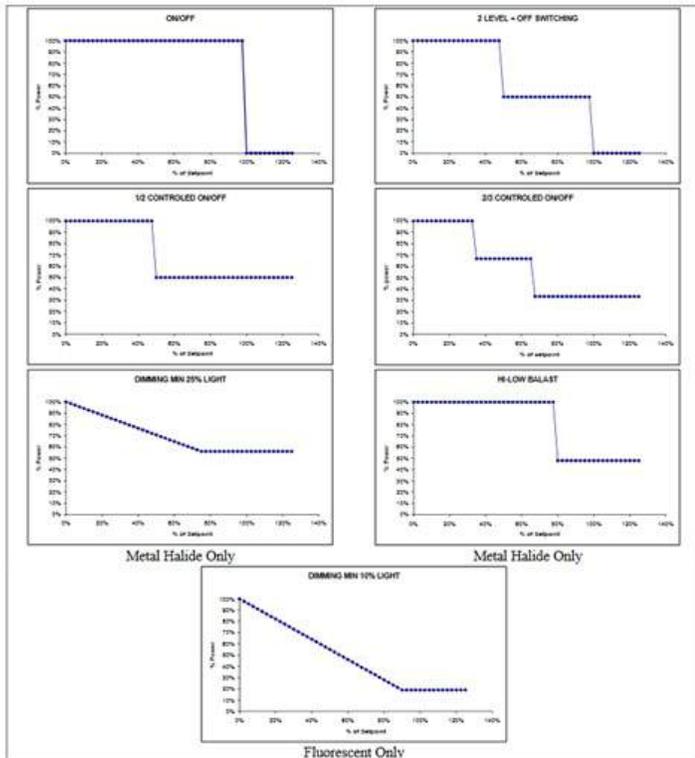


Figure 4: Lighting Power in Response to Photocontrols

However, equal or greater importance is that multi-level plus off switching is less disruptive than on/off switching as the light level changes are smaller. Continuous dimming is even less intrusive with imperceptible light level changes.

Except for offices, classrooms, laboratories and library reading rooms (which require continuous dimming plus off), the current IECC daylighting controls requirements in Section C405.2.3.1 only require on/off controls. This proposal recommends that the daylighting controls be at least multi-level.

Table 6: Fixed Rate LCC Cost Savings per Square Foot of Daylit Area from Photocontrols

Warehouse LPD = 0.7												
Climate zone 3			Fluorescent setpoint = 20 fc					Metal Halide setpoint = 13 fc				
SFR	Effective Aperture	On/Off	Two level 1/2 + off controlled switching on/off	2/3 controlled on/off	Dimming min 10% light	On/Off	Two level 1/2 + off controlled switching on/off	2/3 controlled on/off	Dimming min 25% light	hi/lo ballast		
1.9%	0.6%	\$0.77	\$1.25	\$0.87	\$1.08	\$1.45	\$1.31	\$1.63	\$0.97	\$1.32	\$0.99	\$0.79
2.6%	0.8%	\$1.23	\$1.63	\$1.01	\$1.31	\$1.68	\$1.69	\$1.96	\$1.12	\$1.48	\$1.08	\$0.97
3.2%	1.0%	\$1.53	\$1.88	\$1.11	\$1.42	\$1.82	\$1.91	\$2.13	\$1.18	\$1.58	\$1.13	\$1.07
3.9%	1.2%	\$1.74	\$2.04	\$1.17	\$1.52	\$1.92	\$2.09	\$2.28	\$1.23	\$1.65	\$1.17	\$1.15
4.5%	1.4%	\$1.90	\$2.17	\$1.22	\$1.59	\$2.00	\$2.22	\$2.39	\$1.28	\$1.72	\$1.20	\$1.21
5.2%	1.6%	\$2.02	\$2.26	\$1.25	\$1.65	\$2.06	\$2.31	\$2.47	\$1.32	\$1.75	\$1.22	\$1.25
5.8%	1.8%	\$2.13	\$2.35	\$1.28	\$1.69	\$2.11	\$2.38	\$2.54	\$1.35	\$1.79	\$1.24	\$1.28
6.4%	2.0%	\$2.22	\$2.43	\$1.32	\$1.73	\$2.15	\$2.44	\$2.59	\$1.37	\$1.83	\$1.26	\$1.31
7.1%	2.2%	\$2.29	\$2.53	\$1.36	\$1.76	\$2.19	\$2.50	\$2.64	\$1.39	\$1.85	\$1.27	\$1.34
7.7%	2.4%	\$2.34	\$2.53	\$1.36	\$1.78	\$2.21	\$2.54	\$2.68	\$1.40	\$1.87	\$1.28	\$1.37
Retail LPD = 1.6												
Climate zone 3			Fluorescent setpoint = 65 fc					Metal Halide setpoint = 40 fc				
SFR	Effective Aperture	On/Off	Two level 1/2 + off controlled switching on/off	2/3 controlled on/off	Dimming min 10% light	On/Off	Two level 1/2 + off controlled switching on/off	2/3 controlled on/off	Dimming min 25% light	hi/lo ballast		
1.9%	0.6%	\$0.00	\$0.48	\$0.48	\$0.88	\$1.70	\$0.17	\$1.56	\$1.48	\$1.95	\$1.70	\$0.64
2.6%	0.8%	\$0.00	\$1.08	\$1.08	\$1.61	\$2.33	\$1.54	\$2.74	\$1.97	\$2.53	\$2.03	\$1.24
3.2%	1.0%	\$0.23	\$1.57	\$1.45	\$2.09	\$2.86	\$2.35	\$3.41	\$2.24	\$2.94	\$2.23	\$1.60
3.9%	1.2%	\$1.10	\$2.30	\$1.75	\$2.42	\$3.26	\$2.96	\$3.91	\$2.43	\$3.22	\$2.37	\$1.93
4.5%	1.4%	\$1.74	\$2.88	\$2.01	\$2.71	\$3.58	\$3.50	\$4.35	\$2.60	\$3.43	\$2.49	\$2.17
5.2%	1.6%	\$2.22	\$3.29	\$2.18	\$2.98	\$3.82	\$3.91	\$4.69	\$2.73	\$3.56	\$2.57	\$2.33
5.8%	1.8%	\$2.67	\$3.63	\$2.29	\$3.17	\$4.03	\$4.25	\$4.94	\$2.82	\$3.70	\$2.64	\$2.45
6.4%	2.0%	\$3.01	\$3.92	\$2.42	\$3.30	\$4.20	\$4.48	\$5.13	\$2.89	\$3.81	\$2.70	\$2.58
7.1%	2.2%	\$3.32	\$4.17	\$2.51	\$3.43	\$4.35	\$4.67	\$5.29	\$2.95	\$3.92	\$2.75	\$2.68
7.7%	2.4%	\$3.66	\$4.44	\$2.60	\$3.51	\$4.46	\$4.87	\$5.44	\$3.00	\$4.00	\$2.79	\$2.79

Bibliography: CASE (2002) Codes and Standards Enhancement. Updates to Title 24 Treatment of Skylights.

https://mchughenergy.com/papers/2002-05-17_SKY-LT_PROP_T24.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If dimmable lighting is used such as the case with most LED luminaires, the cost impact is zero. Given the expansion of LED lighting, this is the most common outcome. If the light source is not dimmable the incremental cost between a one channel and two channel switching controller is around \$0.10/sf whereas the life cycle incremental savings are several times that amount. Thus multilevel controls reduce the life cycle cost of the system.

Public Comment 2:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted for the following reasons:

-It allows more technical options for daylight responsive controls.

-It is more technically neutral than CE-185, as the requirements in this proposal will allow the use of high-efficiency technologies such as HID lamps (metal halide, etc.) in high-bay and other commercial applications. A minimum code should be technology neutral where possible.

-It provides more choices for building designers and owners.

-It will save energy compared to the current code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This will increase the requirements for more controls.

Proposed Change as Submitted

Proponents: Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

2018 International Energy Conservation Code

Revise as follows:

C405.2.6.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.6.2 shall ~~be~~ comply with the following:

1. ~~Be~~ controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:
 - ~~1.1.~~ From not later than midnight to not earlier than 6 a.m.
 - ~~1.2.~~ From not later than one hour after business closing to not earlier than one hour before business opening.
 - ~~1.3.~~ During any time where activity has not been detected for 15 minutes or more.
2. Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 W and a mounting height of 24 feet or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. No more than 1500 W of lighting power shall be controlled together.

Reason: Parking lot lighting offers more controllability and energy efficiency through the prolific use of solid state light sources. In prior versions of the IECC, the lighting setback control to reduce lighting wattage was limited to just 30% due to legacy lighting source limitations. Solid state lighting sources now allow a greater control range and dimmability of exterior luminaires than in the past. Changing the wattage reduction from 30 to 50% maintains sufficient exterior illumination after business operating hours when occupancy is reduced, yet is able to save an additional 20% in lighting wattage over the prior IECC versions. A 50% lighting setback wattage reduction has been part of other energy codes for a number of years. This change allows the IECC to remain consistent with the practice and efficiency of other codes.

Providing lighting when it is needed, through activity detection, has been long proven as one of the most efficient and effective ways to control lighting. In outdoor environments, as parking lots, detection technology is widely available. Many outdoor luminaires come with options to include detection technology directly integrated in the luminaire. These controls add some cost to the parking lot luminaires, but offer good payback. The amount of occupancy in parking lots ranges by exterior use type. Office building exteriors show 29% occupancy (using the proposed 15 minute time delay) during normally scheduled occupancy of 6pm to midnight. This allows lighting that might normally be at 100% to be reduced to 50% for 71% of the time, when controlled by activity detection. By comparison, an outdoor shopping center experiences a 79% occupancy. Even with this broad range of exterior occupancy rates, there still remains consider opportunity to reduce the lighting level with minimal impact to use.

Bibliography: Nonresidential Outdoor Lighting Controls, Codes and Standards Enhancement Initiative, Measure Number: 2019-NR-LIGHT3F, September 2017

Use of Occupancy Sensors in LED Parking Lot and Garage Applications: Early Experiences, Gateway Demonstrations, U.S. Department of Energy, Prepared by: Pacific Northwest National Laboratories, October 2012

Outdoor Lighting and Controls, Codes and Standards Enhancement Initiative, California Utilities Statewide Codes and Standards Team, October 2011

Cost Impact: The code change proposal will increase the cost of construction

This proposal increases the cost of construction due to the lighting controls needed for this requirement. This proposed change increases energy efficiency by an additional 20% during after hour periods and when there is no occupancy in the occupancy sensor-controlled area and provides payback for the increased cost of construction.

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: Provides substantial energy savings for outdoor lighting and handles safety issues. This can be a safety aid, as lighting levels increase due to activity and draw attention to areas of activity where it's not planned. The requirement are not to abridge safety, lighting designers are responsible to design accordingly (Vote: 8-7).

Individual Consideration Agenda

Public Comment 1:

IECC@: C405.2.6.3

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.2.6.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.6.2 shall comply with the following:

1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:
 - 1.1 From not later than midnight to not earlier than 6 a.m.
 - 1.2 From not later than one hour after business closing to not earlier than one hour before business opening.
 - 1.3. During any time where activity has not been detected for 15 minutes or more.
2. Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 W and a mounting height of 24 feet or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. No more than 1500 W of lighting power shall be controlled together.

Exception: During rain, snow, or fog weather lighting shall operate at 100% output.

Commenter's Reason: The intent of this proposal is to provide an exception for inclement weather to allow 100% lighting output.

As currently written, during inclement weather, such as heavy rain, fog, or snow, when the visibility of the sensor is limited, the lights will stay dimmed below 50%, creating a higher safety and security risk.

While this may increase energy usage, it will also increase safety and security. In addition, other proposals that have been approved will increase the efficiency of all outdoor lighting systems, which will more than compensate for the minimal increase in energy usage with this exception.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This public comment is perceived that existing controls have the capability of performing as allowed under this proposal, therefore no additional cost would be incurred.

Public Comment# 1583

Public Comment 2:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: There are security concerns with reducing the lighting limits to 50% as well as having them on sensors.

At times when there are no shoppers in a shopping center, there are still lighting needs. Many stores will have cleaning crews visiting the location,

and also employees that will utilize the parking areas, full light is needed for security. If the lights are not 100% functional there could be security issues with not enough light. There are many instances of electronics not functioning in the cold winter weather. This could render the sensors inoperable, and who knows how they will react and the fact that they will probably not react properly when needed. Snow in the winter will also create these to be overridden, and not function as designed. There are also other items that can trip the sensors such as birds and large bugs.

There is also a concern of zoning codes and the lights flickering on and off causing issues for neighboring properties causing nuisance complaints.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1567

Public Comment 3:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:

-It would require parking lot lights to be dimmed while a business is still open.

-It does not have any exceptions for inclement weather (snow, heavy rain, fog), so lights would be dimmed when they are needed at full brightness for safety and security reasons. In those conditions, there is a higher likelihood that they will not sense people, due to limited visibility.

-Sensors can be affected by condensation and/or dirt on the lens, which also reduces visibility (the sensor will have a harder time sensing people and movement).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Disapproval will not change the current code.

Public Comment# 1309

CE199-19

IECC: C405.2.7 (New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Add new text as follows:

C405.2.7 Parking Garage Lighting Control. Lighting for parking garage shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft².
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 30 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Reason: Adding this language will:

1. Reduce inconsistency and confusion with the application of lighting controls in parking garages.
2. Align code language and implementation with other energy efficiency codes.
3. Reduce energy use.
4. Resolve compliance in application and inspection.

Currently there is confusion on how to apply the requirements of the 2018 IECC to parking garage applications. Is it to be treated as an interior space, and if so, how are the control requirements applied that has different use needs than building interior spaces? The Daylight Responsive Controls of section C405.2.3 do not provide proper guidance for how to control lighting in a parking garage setting. This proposal provides proper daylight responsive control and exceptions that meet the design needs and operation of parking garages.

There is some relative increase in cost due to adding occupancy sensing control to reduce the lighting level when there is no activity in controlled lighting zones.

Adding a parking garage specific control section, there is improved clarity in parking garage application, increased energy efficiency in lighting operation and better compliance through requirements that meet the application needs of parking garages.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will increase the cost of construction. Proposed language is mostly a clarification and editorial in nature. There is a small increase in construction cost with the added controls for partial automatic off that provide a payback during the long operating hours of a parking garage structure.

CE199-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C405.2.7 Parking Garage Lighting Control. Lighting for parking garage_s shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft².
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within ~~3~~20 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.

Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.

Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Committee Reason: This improves the code. You can not violate the safety aspects of the code. The modification corrects a dimension to align with original intent of the proposal (Vote: 8-7).

Assembly Action:

None

CE199-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.2.7 (New)

Proponents:

Jack Bailey, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. Lighting for parking garages shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft².

Exception: Lighting zones provided with less than 1.5 foot-candles of illumination on the floor at the darkest point with all lights on are not required to have automatic light reduction controls.

3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 20 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.

2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: Safety.

Wherever I am in a parking garage, and regardless of how I got there, the IBC requires that a minimum of 1 foot-candle be provided on the floor in a continuous pathway connecting me to two exits. It is not permissible to have occupant sensors reduce light levels below this 1 foot-candle minimum in these pathways. There are two valid reasons for this:

1. I need to see my way to the exit, and know before I proceed that the path I take will be free of hazards.
2. Occupant sensors are not tested in smoke, and there is good reason to believe that they will not work in smoke, meaning that lights controlled by occupant sensors would turn on in a fire, could even turn off while the control zone is occupied.

Because of this, we must make sure that the minimum 1 foot-candle is maintained at all times the parking garage is occupied, and that this minimum light level is not compromised by occupant sensor controls. This is essential.

It is also important to remember that most parking garages are designed to 1 foot-candle minimum with all lights on full. In other words, this exception is not needed for the rare parking garage that is underlighted - it is needed for the majority of parking garages.

Finally, we should keep in mind that it is more efficient to design the lighting a parking garage to a minimum of 1 foot-candle than to design it to a higher light level with occupant sensor controls. In this way, the proposed exception actually improves energy efficiency by encouraging designers to design to lower light levels.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The public comment will reduce the cost of construction by limiting the requirement that occupant sensor controls be provided. The code change proposal itself increases the cost of construction with or without the public comment.

Public Comment# 1770

Public Comment 2:

IECC®: C405.2.7 (New)

Proponents:

Jack Bailey, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. ~~Lighting for parking garages shall comply with the following:—~~ Parking garage lighting shall be controlled by an *occupant sensor* complying with Section C405.2.1.1 or a *time-switch control* complying with Section C405.2.2.1. Additional lighting controls shall be provided as follows:

- ~~1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.~~
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft².
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 20 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: Parking garages are not exempt from the timeswitch and occupant sensor control requirements currently in the code. However, this is also true of Section C405.2.4.1 (Specific application controls), and we have repeated this requirement in C405.2.4.1 so it probably makes sense to do the same here for consistency.

Nevertheless, it is important that we re-phrase this because as currently written, the proposal would require that both occupant sensors and time-switch controls be provided in all parking garages, and there is no need for this in smaller parking garages less than 3,600 square feet.

Moving this language to C405.2.7 also eliminates the awkward wording in the current proposal ("Lighting for parking garages shall comply with the following." when the following requirements pertain only to lighting controls, not lighting).

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal will increase the cost of construction by requiring more extensive use of lighting controls in parking garages.

This code change proposal will reduce the additional cost slightly by eliminating redundant controls requirements for smaller parking garages less than 3,600 square feet.

Public Comment# 1771

Public Comment 3:

IECC@: C405.2.7 (New)

Proponents:

Jack Bailey, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. Lighting for parking garages shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft².
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 20 ft of perimeter wall openings ~~or fenestration~~ shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening ~~or fenestration~~-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening ~~or fenestration~~ to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening ~~or fenestration~~ to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: The daylight responsive controls requirements in the code are already applicable to parking garages. However, daylight responsive controls are only required adjacent to fenestration, which is rarely provided in parking garages.

So first of all it is unnecessary to add the word fenestration here, because when a parking garage has fenestration it is already required to have daylight responsive controls adjacent to the fenestration. And second, by adding the word fenestration here, we create a conflicting set of

requirements in parking garages with fenestration, where Section C405.2.3 has one set of requirements, and this section would have a different set of requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal would increase the cost of construction by requiring the installation of additional lighting controls within parking garages.

This public comment would not alter construction costs in any meaningful way.

Public Comment# 1772

Public Comment 4:

IECC@: C405.2.7 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. Lighting for parking garages shall comply with the following:

1. Parking garage exterior lighting shall have automatic time-switch ~~control shutoff~~ in accordance with Section ~~C405.2.2.1~~ C405.2.6.4
2. Lighting power of each luminaire shall be automatically reduced by not less than 30 percent when there is no activity detected within a lighting zone for ~~60~~ 20 minutes. Lighting zones for this requirement shall be no larger than 3600 square feet.
~~Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.~~
3. The power to luminaires within 20 feet of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50 percent.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40 percent as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: While I do not agree with the energy code infringing on components I would consider life safety and egress, and no amount of energy saved is worth the decrease of my safety or anyone else's safety. The proposal as it stands needs to be addressed and corrected if it does actually make it through for voter consideration.

#1 addresses that this is for the exterior lighting of parking garages. I do not believe that the interior lighting of an enclosed parking garage would be on a timer to be shut off. The referenced section was changed to the time switch controls for exterior lighting. The correct wording was provided for the title of the section referenced. The testimony provided for this proposal spoke about the light from the exterior of the parking garage filtering into the surrounding buildings, so it makes sense to reference the exterior lighting control section.

#2 changes the time from 20 minutes to 60 minutes. Again this is a safety issue for everyone. The time frame of 20 minutes is not long enough time to address any issues that can arise. Remember this is a parking garage where vehicles break down, don't start, have a flat tire, locking your keys in the car, or a plethora of other issues. You are at the mercy of assistance from someone else to assist you. More than likely you will wait in your car, if that is a possibility. After 20 minutes the occupancy sensor would kick in. 20 minutes is not long enough time for a tow truck, or car service or friend/family member to pick you up. This is not an office or a room where the light reducing really has no consciences.

#3 is deleted because this requirement contradicts the exception found in C405.2.6. The original proposal did not delete this exception from the mentioned section, and we do not knowingly create contradictions within the code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Public Comment 5:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: I do not agree with the energy code infringing on components I would consider safety, public health and general welfare of the public. No amount of energy saved is worth the decrease of my safety or anyone else's safety.

The testimony provided on this proposal spoke about exterior lighting infiltrating the buildings near the parking garages. I believe addressing the amount of exterior lighting should be addressed and not create an unsafe situation. There are many issues with this proposal as it is currently written.

Requirement #1 states for parking garages requires the lighting to be on automatic shutoff and then references the time-switch control section. An enclosed garage where daylighting is not penetrating should not be on a timer to shut off. This contradicts the requirement of a minimum 1 footcandle at the walking surface for the means of egress found in Section 1008.2 of the IBC.

Requirement #2 -The time frame of 20 minutes is not long enough time to address any issues that can arise in a parking garage where vehicles break down, don't start, have a flat tire, locking your keys in the car, or a plethora of other issues. You are at the mercy of assistance from someone else to assist you. More than likely you will wait in your car, if that is a possibility. After 20 minutes the occupancy sensor would kick in. 20 minutes is not long enough time for a tow truck, or car service or friend/family member to pick you up. This is not an office or a room where reducing the lighting has no consciences.

If you add the two requirements listed as 1 and 2 the lighting of a parking garage would contain both time-switch control and an occupancy sensor. In Sections C405.2.2 it states if the area is not provided with an occupancy sensor it has a time-switch, but no where does it require both controls for interior lighting within the code currently. Why would a condition, that in my opinion fall under the exception of Section C405.2 and Section C405.2.1.1 of the IECC require more lighting controls than a room used as an office.

The requirement #3 contradicts the exception found in C405.2.6. We do not knowingly create conflicts within the code, and this does.

Let's discuss what the potential consciences are of this proposal. The reality is this is a very unsafe situation. I do not want to be stuck in a parking garage that has a potential of myself being raped, robbed, or other possibilities, and I know that I am not alone in this. This proposal diminishes my safety and security. This is not just a female issue, but it is a reality we have to face on a daily basis. Would you want your 18 year old daughter whose beater car breaks down and is stuck in a parking garage where these conditions exist? No respectable parent would want to place their child knowingly in a dangerous situation. I have personally had incidents in parking garages, and I can't imagine how it may have ended if they were required to comply with this proposal. I know other women who have had similar and worse situations than my own. I have spoken against occupancy sensors in stairwells and parking garages for cycles as they keep coming up because I know the unsafe situations they can be, and why would you want to decrease the safety of key elements as such. I will end my reason statement as I started this reason statement. No amount of energy saved is worth the decrease of my safety or anyone else's safety.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

ENERGY INTENSITY COMPARISONS

	Typical Site EUI* kBtu/sf	kWh/sf (of flowering canopy)	grams/kWh (of final product in flower form)
 Outdoor (Sungrown)**	n/a	0	16
 Greenhouse (Light Deprivation)**	84	33	8
 Indoor (Efficient)**	-600	234	1+
 Indoor (Inefficient)**	-1300	500+	1-
 Office Building***	67	n/a	n/a
 Hospital***	197	n/a	n/a
 Data Center***	-600	n/a	n/a

*Assumes 75% of grow facility floor space is used for flowering canopy
 **Data source: Self-Reported producer data from the Resource Innovation Institute Cannabis PowerScore
 ***Data source: US Energy Star Portfolio Manager

The price of LEDs has fallen dramatically in the past few years and local food movements in cities are driving increased demand for fresh high-quality produce that is grown close to the point of consumption. More restaurants are interested in sourcing ingredients directly from the producer, and in dense urban areas a growing number of new indoor agriculture operations have begun to meet this demand. This potent combination of policy, technology, and market factors is driving a dramatic expansion in indoor agriculture. As written, the 2018 IECC leaves lighting in this growing energy load completely exempt from efficiency requirements.

This proposal removes the loophole by requiring lighting used for plant growth or maintenance to either meet an efficiency metric. The efficiency metric of 1.6 μmol/J (micromoles per Joule) was developed in collaboration with the American Society of Agricultural and Biological Engineers and was developed specifically for lighting used for plant growth. It measures the number of photons emitted from the fixture per Joule of energy consumed. Lighting Power Density was developed as a metric to evaluate the light usable for visual tasks relative to the power consumed. Likewise, this metric was developed specifically to measure the light usable for plant growth relative to the power consumed. This metric is codified as an ANSI standard (ANSI/ASABE S640 – Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)) and is already seeing wide adoption in the industry with over 84 products available that meet this requirement when surveyed in 2016. More information on the metric can be found in the ANSI Standard: ANSI/ASABE S640.

Using a typical High Pressure Sodium lamps (a common growing light) as the baseline, this requirement will result in 78% savings. That is a substantially lower lighting load and a reduction in the cooling load.

Cost Impact: The code change proposal will increase the cost of construction

The proposal could marginally add to the cost of construction. The cost of horticultural lighting fixtures is actually driven to a large extent by reflectors and ventilation needs (horticultural lighting is positioned very close to the plants and venting the heat is essential) and not just lighting technology. Therefore, fixture cost can vary dramatically, from \$25/fixture to almost \$1000/fixture for High Pressure Sodium fixtures and from \$75/fixture to well over \$1000/fixture for LED. And advancements and expanding market share of LED lighting has narrowed the impact of lighting technology. Therefore, lighting that meets this requirement can be obtained for less than lighting that does not. The only projects that will see an increase in cost are those using the absolute cheapest lighting that does not meet the requirement.

CE209-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C405.4 Lighting for plant growth and maintenance (Mandatory). Not less than 95 percent of the permanently installed luminaires used for plant growth and maintenance shall have a photon efficiency of not less than 1.6 μmol/J ~~rated~~ as defined in accordance with ANSI/ASABE S640.

Committee Reason: This change provides jurisdictions the opportunity to enforce lighting. The modifications add the word mandatory, clarifying intent it is mandatory and non tradeable and corrects a more appropriate term for reference standard. (Vote: 14-1).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective

Individual Consideration Agenda

Public Comment 1:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:

-The requirement shown is a "photon efficiency" for the process of growing plants and crops. A higher photon efficiency does not mean higher lighting energy efficiency.

-The energy used by lighting depends on the type of structure and lighting technology. Based on a 2017 DOE report, the lighting energy usage. A supplemented greenhouse will have different lighting energy usage compared to non-stacked indoor farm and as compared to a vertical farm. For facilities using LED lighting, the lighting energy usage density ranged from 7.3 to 41.8 Watts/square foot. For facilities with HID lighting (high pressure sodium or metal halide), the lighting energy usage density ranged from 10.4 to 60.8 Watts/square foot, and for facilities with fluorescent lighting, the lighting energy usage density ranged from 22.8 to 60.0 Watts/square foot.

-It is not clear if this requirement is applicable to all plants/crops that could be grown in these types of facilities, or just a few (e.g., Basil/herbs, cabbage, cannabis, carrots, cucumbers, flowers, grapes, green peas, chickpeas, lentils, leafy greens, lettuce, onions, peppers, squash, strawberries, blueberries, tomatoes, etc.).

-According to a May 2018 report by the Lighting Research Center for greenhouse applications:

"The LRC found that LED horticultural luminaires cannot replace HPS luminaires on a one-for-one basis while still maintaining the original PPFD. Approximately three times as many LED horticultural luminaires would be needed to provide the same PPFD as a typical HPS horticultural luminaire layout, on average.

The results show that intensity distribution plays an important role, illustrated by the fact that two of the tested LED luminaires had higher luminaire efficacy than the HPS luminaires but still had a higher total power demand in the greenhouse application.

The LRC found an increase in shading from LED luminaires compared with HPS luminaires due to the size of the luminaires and the fact that more are needed to provide the same PPFD in a greenhouse. The shading from LED luminaires reduces daylight in a greenhouse by 13—55% compared with a 5% reduction in daylight from HPS luminaires, thus more electric energy could be needed for lighting with the LED systems, depending upon the available daylight."

Bibliography: *Energy Savings Potential of SSL in Horticultural Applications*, US Department of Energy, DOE/EE-1723, December 2017 available at: https://www.energy.gov/sites/prod/files/2017/12/f46/ssl_horticulture_dec2017.pdf

LED and HID Horticultural Luminaire Testing Report, Lighting Research Center, Rensselaer Polytechnic Institute, May 3, 2018, available at <https://www.lrc.rpi.edu/programs/energy/pdf/HorticulturalLightingReport-Final.pdf>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. There is no change to code if this is disapproved.

Public Comment# 1315

CE213-19

IECC@: C405.8.2, C405.8.2.1

Proposed Change as Submitted

Proponents: Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

2018 International Energy Conservation Code

Revise as follows:

C405.8.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 ~~and~~ Where a traffic analysis indicates that an escalator or moving walk application will have sufficient periods with no riders while it is operating, it shall have automatic controls configured to that reduce speed to the minimum as permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.

Exception: A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.

C405.8.2.1 Regenerative drive. Power Recovery. ~~An escalator designed either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded. Where a traffic analysis indicates that an escalator application will have sufficient periods in the down direction with passengers whose combined weight exceeds 750 pounds (340 kg)- kg), the escalator shall be designed to recover, on average, more power than is consumed by the power recovery feature of its motor controller system.~~

Reason: The universal application of technology designed for energy efficiency improvement imposed by the current requirement may actually increase energy consumption in many applications. The proposed revision would require a traffic analysis to determine whether the technology would actually be beneficial or detrimental. The proposal also used more prescriptive language for the power recovery to allow designers and manufacturers to select the most energy efficient technology for the application.

C405.8.2: Depending on the escalator or moving walk application, varying speeds may actually increase energy usage. Each time the escalator or moving walk returns to the normal operating speed from its reduced speed condition, more energy is consumed to create the acceleration needed. In applications where the amount of time that there are no riders is very short, the energy consumed during the acceleration stage may actually exceed what is saved during the reduced speed segments. The traffic analysis can be used to calculate the anticipated savings, if any, to determine whether the technology should be applied and the return on investment.

C405.8.2.1: It should be noted that most, if not all, escalators are designed to be reversible, so the provision in the current edition would be applied to all escalators, including those that always run in the up direction. Depending on the escalator application, there may be only marginal gains in applying one technical solution over another and therefore no single technical solution should be prescribed for all escalators as stated in the current standard. The proposed language uses more prescriptive language for the power recovery to allow designers and manufacturers to select the most energy efficient technology for the application and ensure that if applied it actually recovers more power on average than the added feature would consume. [Note: some examples may include direct induction motor regeneration, variable frequency regeneration motor controller, or various combinations of the two.]

To further illustrate the deficiencies in the current language and support the need for an analysis to determine the best option for energy usage, three hypothetical scenarios are provided below with three configurations of motor controller-motor energy recovery arrangements. In each configuration, power recovery (regen power) back to the supply system can only be realized when the escalator is running in the down direction with a sufficient load to overcome friction. (See sample motor controller configuration diagrams under Technical Backup).

Electrical DATA

Rise: 18' (approx. 6m)

Power: 15Hp/11kW

Power factor (Pf) 0.75

Voltage: 480VAC

Configuration 1 is an electro-mechanical motor controller with an AC induction motor that can feed direct power back to the power supply system when the escalator is running in the down direction with sufficient load.

Configuration 2 is an electronic motor controller with no regeneration capability but can reduce escalator speed when there are no riders on it, and uses the AC motor to feed direct power back to the power supply system when the escalator is running in the down direction with sufficient load.

Configuration 3 is an electronic motor controller with regeneration capability back to the power supply system when the escalator is running in the down direction with sufficient load driving an AC induction motor.

A) Approximate additional energy consumption (kW/hr.) by the controller for the four types of motor controls considered (electro-mechanical is baseline):

1. Electro-mechanical motor controller with AC induction motor ~ 0 kW
2. Electronic motor controller (VVVF) without regen and with AC induction motor ~ 0.285 kW
3. Electronic motor controller (VVVF Pf1 regen type) with AC induction motor ~ 0.430 kW

B) Approximate energy saved (kW/hr.) at reduced speed for the three types of motor controls considered:

1. Electro-mechanical motor controller with AC induction motor ~ 0 kW (reduced speed not possible)
2. Electronic motor controller (VVVF) without regen and with AC induction motor ~ 1.5 kW
3. Electronic motor controller (VVVF Pf1 regen type) with AC induction motor ~ 1,5 kW

C) Approximate energy recovered (kW/hr) by the escalator for the three types of motor controls considered:

1. Electro-mechanical motor controller with AC induction motor ~ 3 kW
2. Electronic motor controller (VVVF) without regen and with AC induction motor ~ 3 kW
3. Electronic motor controller (VVVF Pf1 regen type) with AC induction motor ~ 4 kW

Summary: From the three application scenarios below, it will be seen that the energy savings from each configuration very much depends upon the application and use of the escalator:

- The single dedicated down airport escalator in Scenario 1 with the VVVF Pf1 regenerative motor controller of Configuration 3 provides the best energy efficiency. This configuration is specified by the current standard.
- The single up escalator with a peak hour down direction in scenario 2 is better suited with the VVVF motor controller in Configuration 2 that can reduce the speed of the escalator when no riders are present but uses the AC motor to feed direct power back to the power supply system when the escalator is moving in the down direction with sufficient load.
- The heavily used bi-directional shopping mall escalators in Scenario 3 will consume more energy with the added speed reduction and power recovery features of Configuration 2 and 3 than they would by simply allowing the AC induction motor of Configuration 1 to recover direct energy from the induction motor whenever possible.

The NEII proposed code modifications address the application sensitivity in achieving energy recovery and savings by making the application of the conveyance a factor in selecting the best suited energy saving configuration.

Application Scenario 1

An airport is open 18 hours per day with a dedicated down escalator to baggage claim. When flights arrive, it is loaded with more than 75% capacity for 5 minutes for each flight and zero load the remainder of the time. One hundred and twenty arriving flights per day use this baggage claim escalator.

Escalators load during the 18 operating hours:

1. 0% load for 8 hours (=Total time where reduced speed can be applied)
2. > 0%, < 75% load for 0 hours
3. 75% load or more for 10 hours

Motor Controller (Operating 18 hours/day)	A) Controller power ~kW consumption	B) Reduced speed ~kW saved	C) Regen ~kW recovered	Energy saved Power ~kW

Direction	Up	Down	Up	Down	Up	Down	Total
1. Electro-mechanical with AC induction motor that provides regen	0	0	0	0	0	30	30
2. Electronic controller with AC induction motor that provides power recuperation capability	0	5.1	0	12	0	30	38.90
3. Electronic controller (Pf1 regen type) with AC induction motor	0	7.74	0	12	0	40	44.26

Application Scenario 2

A subway station open 22 hour per day has one escalator for each platform. Typically, the escalator runs in the up direction most of the time and in the down direction during peak rush hour. Scenario for reduced power consumption and regen power is as follows:

Escalators load during the 22 operating hours (20hrs up and 2hrs down):

1. 0% load for 10 hours up direction (Total time where reduced speed can be applied)
2. > 0%, < 75% load for 10 hours up direction
3. 75% load or more for 2 hours down direction

Motor Controller (Operating 22 hours/day)	A) Controller power ~kW consumption		B) Reduced speed ~kW saved		C) Regen ~kW recovered		Energy saved Power ~kW
	Up	Down	Up	Down	Up	Down	Total
Direction	Up	Down	Up	Down	Up	Down	Total
1. Electro-mechanical with AC induction motor that provides regen	0	0	0	0	0	6	6
2. Electronic controller with AC induction motor that provides power recuperation capability	5.7	0.57	15	0	0	6	14.73
3. Electronic controller (Pf1 regen type) with AC induction motor	8.6	0.86	15	0	0	8	13.5

Application Scenario 3

A busy outdoor mall is open 12 hours per day has two escalators. Typically, one of the escalators will be running up and the other in the down direction. Both escalators can run down and each may be used for that direction from time to time. Scenario for reduced power consumption and regen power is as follows:

Escalators load during the 12 operating hours:

1. 0% load for 0 hours (Total time where reduced speed can be applied)
2. > 0%, < 75% load for 12 hours
3. 75% load or more for 0 hours

Motor Controller (Operating 12 hours/day)	A) Controller power (~kW) consumption		2) Reduced speed (0hrs) ~kW saved		3) Regen (0hr) ~kW recovered		Energy saved Power ~kW
	Up	Down	Up	Down	Up	Down	Total
Direction	Up	Down	Up	Down	Up	Down	Total
1. Electro-mechanical with AC induction motor	0	0	0	0	0	0	0
2. Electronic controller with AC induction motor that provides power recuperation capability	3.4	3.4	0	0	0	0	(6.8)
3. Electronic controller (Pf1 regen type) with AC induction motor	5.16	5.16	0	0	0	0	(10.32)

Technical backup.

Energy is utilized by escalators for the following:

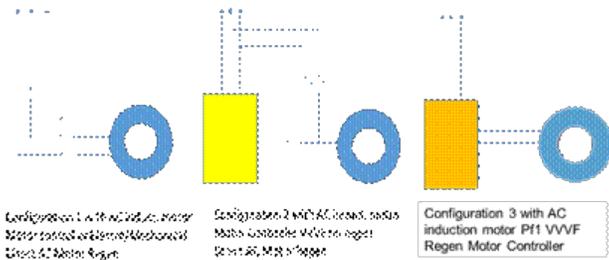
1. to overcome friction,
2. transport the load, and
3. inertia (starting) (insignificant for configuration 1 minimum for the others)

Because of the angle of inclination, transport of the escalator load is the dominate energy consumption area of the system to move a load up the inclination. However, the converse is true that when the load is being transported in the down direction, energy can be produced by the overhauling of the drive motor from the downward moving load and returned to the power system.

In general, an AC induction motor used to drive an escalator will produce power when it is in overhauling in the down direction with sufficient passenger loading to overcome the friction in the system. AC induction motors may be applied with simple electro-mechanical or fully electronic motor controllers and still provide this capability. Other variations of motor types, such as permanent magnet motors and variable voltage variable frequency motor control are also possible, and may also provide an energy saving reduced speed feature in the application. However, the electronics required for the various technologies to provide these motor control functions also consumes energy and must be weighed against the possible energy saving under the application and use of the escalator.

It should also be pointed out that in certain applications, escalators and moving walks with a speed reduction feature are confronted with flows of traffic that can cause the escalator or moving walk to continually switch between full to reduced speed and back to full speed. With a high enough frequency, this switching between slow to full speed will consume more energy than saved by the feature because of the need to accelerate the mass to full speed each time.

Example configurations (basic diagrams)



Cost Impact: The code change proposal will decrease the cost of construction

The code change proposal will decrease the cost of construction because it would allow alternate designs to achieve energy conservation.

CE213-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There are no specific standards for when the escalator needs to slow down, this could be a roll-back. Proponent is encouraged to separate this into two code changes, there is too much reliance on undefined traffic analysis (Vote: 13-2)

Assembly Action:

None

CE213-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C405.8.2

Proponents:

Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.8.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44. ~~Where a traffic analysis indicates that an escalator or moving walk application will have sufficient periods with no riders while operating, it~~ and shall have automatic controls that reduce speed as permitted in accordance with ASME A17.1/CSA B44 ~~or and~~ applicable local code.

Exception: A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.

Commenter's Reason: Proposed modification would result in minor changes to clarify the base requirement. These clarifications would reduce potential redundancy with ASME A17.1/CSA B44 which specifies strict safety requirements for the reduction of speed on escalators and moving walks. Also, the modifications clarify language to prevent conflict with local codes that prohibit a variation of speed or have not adopted the applicable editions of A17.1/CSA B44 that specify the relevant safety requirements. The modified proposal also breaks down the proposal into multiple changes as recommended by the committee.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. This public comment is only a clarification of the proposed language and clarifications do not impact the cost of construction. The net effect of the proposal and public comment will be a decrease in the cost of construction for the reasons stated in the proposal.

Public Comment# 1736

Public Comment 2:

IECC@: C405.8.2

Proponents:

Kevin Brinkman, representing National Elevator Industry, Inc. (kbrinkman@neii.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.8.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44. Where a traffic analysis indicates that an escalator or moving walk application will have sufficient periods with no riders while it is operating, it shall have automatic controls that reduce speed as permitted in accordance with ASME A17.1/CSA B44 or applicable local code.

Exception: ~~A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.~~ Reduction in speed is not required where the application of the escalator or moving walk will have passengers more than 50 percent of the time during powered operation.

Commenter's Reason: Escalators and moving walks are typically powered down during building closing hours. However, while in operation passenger usage conditions for certain applications of the escalator or moving walk may permit only very short periods for the reduction of speed due to the frequency of passenger loading and unloading. In these applications energy reduction during reduced speed may not offset the required energy of the added automatic controls due to the short durations of reduced speed and the energy required for reaccelerating the escalator and moving walk back to full running speed after each speed reduction period ends. The modified language is also structured to be more technology neutral and breaks down the proposal into multiple changes as recommended by the committee.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The proposed change will reduce the cost of construction because it will not require the additional cost and energy consumption of speed varying controls when the application would not be able to produce sufficient cost savings to offset the expense.

Public Comment# 1739

Public Comment 3:

IECC@: C405.8.2.1

Proponents:

Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.8.2.1 Energy Recovery. Regenerative drive. ~~An escalator~~ Escalators shall be designed to recover electrical energy when resisting overspeed in the down direction, either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded with passengers whose combined weight exceeds 750 pounds (340 kg).

Commenter's Reason: This public comment requests approval of the proposed modifications to C405.8.2.1 independent of the other changes in the original proposal based on the committee recommendation to split this into multiple changes. Overall the modification and the change still requires energy saving technology, but allows the building owner, designers and manufacturers more flexibility to ensure that the resulting application actually saves energy.

All escalators are, by the nature of their motor drives, designed to recover electrical power in the down direction when there is enough passenger load to overcome the friction of the escalator system and imbalance of the escalator step masses that will cause the escalator motor to resist over speeding of the escalator. There is no significant marginal energy recovery benefit by specifying any one type of energy recovery solution for escalators. In some applications specifying one technology solution for energy recovery can be counterproductive to that objective since the means to recover the energy also requires power that must be considered among all possible solutions. A single specified solution also hinders innovation in escalator motor drive design.

The stated 750-pound requirement is arbitrary since, as noted above, the inherent friction of an escalator system, including rise, handrail design, and other factors, may need more or may need less than 750lbs of passenger load to cause the escalator motor to resist escalator overspeed in the down direction and recover energy.

To further illustrate the deficiencies in the current language and support the need for an analysis to determine the best option for energy usage, three application scenarios were provided with the original proposal that include three available configurations of motor energy recovery arrangements. In each configuration, power recovery (regen power) to the supply system can only be realized when the escalator is running in the down direction with a sufficient load to overcome friction and energy losses.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This proposal would reduce the cost of construction because it would offer builder owners, designers, and manufacturers more flexibility in the selection of escalators for a given application.

Public Comment# 1741

CE215-19

IECC: C405.10 (New), C405.10.1 (New), C405.10.2 (New), TABLE C405.10.2 (New), C405.10.2 (New), C405.10.4 (New), C405.10.5(New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Add new text as follows:

C405.10 Energy Monitoring (Mandatory) New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section C406.10.1 through C406.10.5.

Exception: Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 5,000 square feet of conditioned floor area.

C405.10.1 Electrical energy metering. For electrical energy, including all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities, and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.10.2.

C405.10.2 End-use metering categories. Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category indicated in Table 405.10.2. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories indicated in Table 405.10.2 shall be permitted to be from a load that is not within that category.

Exceptions:

- 1.HVAC and water heating equipment serving only an individual dwelling unit shall not require end-use metering.
- 2.End-use metering shall not be required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.
- 3.End-use metering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet where a dedicated source meter complying with Section C405.10.3 is provided.

**TABLE C405.10.2
ENERGY USE CATEGORIES**

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
<u>Total HVAC System</u>	<u>Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers, and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.</u>
<u>Interior Lighting</u>	<u>Lighting systems located within the building.</u>
<u>Exterior Lighting</u>	<u>Lighting systems located on the building site but not within the building.</u>
<u>Plug Loads</u>	<u>Devices, appliances and equipment connected to convenience receptacle outlets.</u>
<u>Process Loads</u>	<u>Any single load that is not included in a HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.</u>
<u>Building Operations and other miscellaneous loads</u>	<u>The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas, and snow-melt systems.</u>

C405.10.3 Meters. Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C405.10.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of plus or minus 2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C405.10.4 and C405.10.5.

C405.10.4 Data acquisition system A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C405.10.2.

C405.10.5 Graphical energy report A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C405.10.2 at least every hour, day, month, and year for the previous 36 months.

Reason: The investment made for the infrastructure of a building to comply with the IECC is significant. The assumption that is currently made upon commissioning a facility is that energy efficiency measures will not degrade, or go out of calibration, over time and their energy consumption will not increase as time passes from the time they were commissioned. Such an assumption is completely inaccurate and any payback assumed for energy efficient infrastructure investments will be lengthened, thereby reducing the ROI and increasing the payback period. The only means to retain the energy performance of a building is to continuously monitor energy consumption levels of various energy consuming systems and compare them to previous levels. Monitoring sub-systems provides key indications when changes have been made or systems are not operating to specification, which increases energy consumption. Examples include, but are not limited to:

1. Increase energy consumption in HVAC system loads will point to failures in motors, drive systems, bearings, etc.
2. Degrading building envelope.
3. Configuration changes to the building that may drive increased energy consumption.
4. Increase of energy consumption from lighting loads may indicate changes in arrangement of the office space that resulted in reduced lighting driving the installation of more lighting above permitted energy code levels, failure of occupant sensors, inappropriate lighting schedules, lamps that need to be replaced or cleaned, etc.
5. Monitoring plug loads will indicate when computer equipment is left on during non-working hours and use of space heaters that compromise the efficiency of the facility due to set points on the HVAC system.

The requirements in this proposal save energy by continually monitoring and reporting actionable energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plug loads). There are well documented studies that demonstrate the energy savings from metering and monitoring systems. The 2013 version of ASHRAE Std. 90.1 and several state energy codes have recognized the benefits and require energy monitoring to support a continual high level of performance from the energy efficient investment.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change proposal "will" increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings: https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

CE215-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

C405.10 Energy Monitoring (Mandatory). New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section ~~C406.10.4~~ C405.10.1 through ~~C406.10.5~~ C405.10.5

Exception: R-2 occupancies and Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 5,000 square feet of conditioned floor area.

Committee Reason: Monitoring is important, building owners and operators need to know what energy is being used, the change supports the cities benchmarking requirements. A public comment would be advised lining up dwelling unit language. The modifications clarify exemptions and correct errors in citations (Vote: 10-5).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE215-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C405.10 (New)

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.10 Energy Monitoring (Mandatory) New buildings with a gross conditioned floor area of 250,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section C405.10.1 through C405.10.5.

Exception: R-2 occupancies and Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 50,000 square feet of conditioned floor area.

Commenter's Reason: Smaller commercial buildings should not be required to submeter, since they are much less likely to have on-site technical staff that can respond to short-term or long-term increases in energy usage discovered by the submeters.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

To the extent this modification would reduce the number of buildings subject to submetering provisions, it would reduce the cost of construction.

Public Comment# 1584

Public Comment 2:

IECC@: C405.10.5 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.10.5 Graphical energy report A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel, building owner, and the tenant of each space. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C405.10.2 at least every hour, day, month, and year for the previous 36 months.

Commenter's Reason: This public comment made was to address who receives the reports for the energy use of the building or space. The intent is to monitor the energy usage to be cognitive of how much and how the energy is used within the building or space, but the original proposal left out key players in the mix. If the tenants of the space or owners of the building are not provided with this information they are not able to address any concerns of how one may be wasting energy. Knowledge is power, and this knowledge needs to be provided where it can be useful and used appropriately. If one does not know how much energy is being used one can not fix any wasting measures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment is a clarification as to where/who information needs to be/go. Clarifications do not impact the cost of construction. However, the proposal does impact the cost of constructions as requires installation of a lot of electrical monitoring equipment to buildings and that will increase the cost of construction.

Public Comment# 2041

Public Comment 3:

IECC@: C405.10 (New), C405.10.1 (New), C405.10.2 (New), TABLE C405.10.2 (New), C405.10.3 (New), C405.10.4 (New), C405.10.5 (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.10 Energy Monitoring (Mandatory) New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report electric and fossil fuel energy consumption data in compliance with Section C405.10.1 through C405.10.5.

Exception: R-2 occupancies and Individual tenant spaces are not required to comply with this section provided the space has its own utility services and electric meters, steam meters, and fossil fuel meters and has less than 5,000 square feet of conditioned floor area.

C405.10.1 Electrical and Fossil Fuel and Steam energy metering. For electrical and fossil fuel and steam energy, including all ~~electrical~~ energy supplied to the building and its associated site, including but not limited to site lighting that is fueled or powered through the energy service for the building, parking, recreational facilities, and other areas that serve the building and its occupants, electric and fossil fuel and steam meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.10.2.

C405.10.2 End-use metering categories. Electric and fossil fuel and steam ~~M~~ meters or other approved measurement devices shall be provided to collect energy use data for each end-use category indicated in Table 405.10.2. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the electric and fossil fuel and steam energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories indicated in Table 405.10.2 shall be permitted to be from a load that is not within that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit shall not require end-use metering.

2. End-use metering shall not be required for fire pumps, stairwell pressurization fans or any other system that operates only during testing or emergency.
3. End-use metering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet where a dedicated source meter complying with Section C405.10.3 is provided.

**TABLE C405.10.2
ENERGY USE CATEGORIES**

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC System	Heating, cooling and ventilation including, but not limited to fans, pumps, <u>furnaces</u> , boilers, chillers, and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior Lighting	Lighting systems located within the building.
Exterior Lighting	<u>Electric or fossil fuel</u> Lighting systems located on the building site but not within the building <u>that are fueled or powered through the energy service for the building.</u>
Plug / Pipe Loads	<u>Electric or fossil fuel or steam</u> Devices, appliances and equipment connected to convenience receptacle outlets <u>or fossil fuel supply piping or steam piping.</u>
Process Loads	Any single load that is not included in a HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, <u>laundry equipment</u> , manufacturing equipment and commercial kitchens.
Building Operations and other miscellaneous loads	The remaining <u>electric and fossil fuel and steam</u> loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental <u>gas</u> fireplaces, swimming pools, <u>pool heaters</u> , in-ground spas, and snow-melt systems.

C405.10.3 Meters. Electric and fossil fuel and steam ~~M~~ meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C405.10.4. Source meters shall be allowed to be any digital-type electric or fossil fuel or steam meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. ~~Current~~ Other electric and fossil fuel or steam sensors shall be permitted, provided that they have a tested accuracy of plus or minus 2 percent. Required electric and fossil fuel and steam metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C405.10.4 and C405.10.5.

C405.10.4 Data acquisition system A data acquisition system shall have the capability to store the data from the required electric and fossil fuel and steam meters and other sensing devices for minimum of 36 months. The data acquisition system shall have the capability to store real-time electric and fossil fuel and steam energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C405.10.2.

C405.10.5 Graphical energy report A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the electric and fossil fuel and steam energy consumption for each end-use category required by Section C405.10.2 at least every hour, day, month, and year for the previous 36 months.

Commenter's Reason: As currently written, this code change would only require submetering of electric end-uses, while ignoring fossil fuel and steam end-uses. For buildings in northern climates with multiple fossil-fuel end uses, the majority of energy used and energy costs will be from fossil fuels (and/or steam), not electricity. So, designers and owners will have incentive to install fossil-fuel or steam equipment to lower their submetering costs.

This modification will increase energy savings by ensuring that all forms of energy are submetered, not just electricity. This is fuel neutral, as it requires all forms of energy, not just one, to be submetered. This will ensure that savings can be obtained for all forms of energy that are being used at the building or building site.

There are other editorial improvements to the proposal, and language for exterior lighting has been submitted that is consistent with language that is currently in the IECC (in C405.4.2) and approved for other proposals (such as CE 211). This will prevent any problems with lighting that is provided to the building site by 3rd parties (such as cities, counties, or utilities).

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. Adding more submetering for all forms of energy used will increase the cost of construction.

Public Comment# 1346

Public Comment 4:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: While monitoring energy usage is in the best interest of the owner, mandating it in this detail is not. Many owners monitor certain loads but to the extent the proposal requires is not beneficial. The cost to add the equipment only benefits the manufacturer and installers. This proposal also requires a reporting mechanism, on simple buildings, this is not a good use of resources. Designers know how to limit energy usage by good design, once all this expensive equipment is installed it is not mandated that an owner or tenant do anything with the information. This is a mandate with no need to act on anything.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1589

CE216-19

IECC: C405.10 (New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association

2018 International Building Code

Add new text as follows:

C405.10 Automatic Receptacle Control The following shall be automatically controlled:

1. At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3. Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.

This control shall function on:

1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft² and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft².
2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or
3. An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.

All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space. Plug-in devices shall not comply.

Exceptions: Receptacles for the following shall not require an automatic control device:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

Reason: This proposal will:

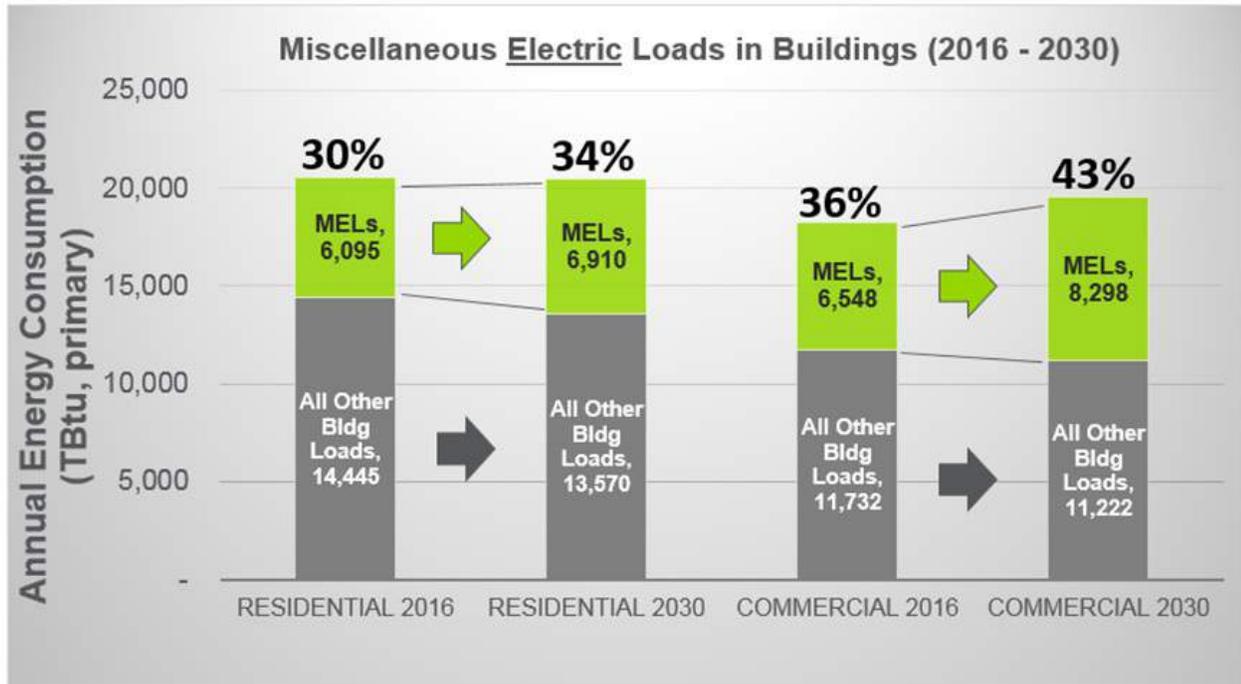
1. Increase building energy efficiency
2. Offer a well-studied, cost effective efficiency measure
3. Maintain building occupant's safe usability
4. Keep enforceability simple
5. Align with other energy efficiency codes, increasing design compliance.

Although commercial buildings continue to decrease their energy use through more efficient lighting, mechanical, and domestic water systems, the Miscellaneous Electrical Loads (MELs) energy segment continues to rise. More and more electrical power consuming devices are being plugged into building electrical systems. Some, such as fans, space heaters, printers, monitors, plug in lamps are left on, when spaces are unoccupied. Other devices may be left plugged in and continue to draw power even when inactive or in standby modes. This wastes energy and is counter to the energy efficiency aim of the IECC.

Some jurisdictions which adopt the IECC for their commercial buildings, like Florida and Washington, have amended the IECC to include automatic receptacle control, thereby addressing the growing energy consumption concern of these loads. For more than eight years, other energy efficiency codes have included automatic receptacle control provisions to reduce the wasted energy. Yet, the IECC lags behind offering no viable solution to the growing receptacle and miscellaneous loads on commercial building electrical systems. The Annual Energy Outlook of 2015 from the US EIA, indicate that these load categories will grow from 36% of a commercial buildings energy use, to 43% over the next 15 years.

Miscellaneous Electric Loads vs Total Building Energy Use

According to EIA Annual Energy Outlook (AEO, 2015), under business-as-usual scenario, contribution of Miscellaneous Electric Loads (MELs, electric) to total building energy consumption is projected to increase from 30% to 34% for the residential sector and from 36% to 43% for the commercial sector for 2016 – 2030.



EIA Annual Energy Outlook, 2015

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

This provision simply assures receptacle loads that are not needed when building occupants leave high receptacle load use areas, are automatically turned off, saving the energy that would otherwise be wasted. It requires that controlled receptacles clearly be marked as required by NFPA 70, to eliminate user confusion of proper use, and provides good practice exceptions where controlling receptacles would endanger safety and security, or areas of continuous operation.

Expressed safety concerns where extensive use of extension cords and plug strips would be used are unfounded. There are no documented studies validating this problem exists. The proposed language requires either a split duplex receptacle with a controlled or uncontrolled receptacle in the same device, or an uncontrolled receptacle be located no more than 12 inches from a controlled receptacle. This provides occupants in an automatic receptacle-controlled space, clear access to both label marked controlled receptacles and uncontrolled receptacles.

Although there are no requirements for receptacle density in commercial buildings, a design professional will ensure there is an appropriate distribution of receptacles to effectively accomplish the mission of the building. There's no evidence that the distribution of receptacle outlets and controlling some of them has any adverse impact on the utility of this requirement.

Enforceability of this provision is straight forward for building departments and their inspectors. Construction drawings indicate which receptacles are controlled and which are uncontrolled. Onsite inspection will clearly show complying labelled receptacles and operation is easily varied with the shut-off controls already in place with the lighting system.

There have been a considerable number of studies over the years that share the viability and cost effectiveness of automatic receptacle control. Some noted here.

1. One study demonstrated effectiveness (e.g. Zhang2012) with simply payback on this type of equipment between 1.5 and 9 years for small and large offices. This considers the most comprehensive information on office plug load types, installation densities, usage patterns, and power states based on field surveys and monitoring (Kawamoto 2000, 2001; Moorefield, Frazer & Bendt 2011; Roberson 2002, 2004; Roth 2002, 2004; Sanchez 2007; Webber 2001, 2005).
2. A CASE initiative study for CA Title 24-2013 found that smaller office buildings (10,000 sqft) had an annual electrical savings of 4,900 kwh/year and a demand savings of 1.97 kW. Based on installed costs and utilization of lighting control system elements already installed. The simple payback was 4.2 years. For larger office buildings (175,000 sqft) the annual electrical savings were 107,000 kwh/year and a demand savings of 23.6 kW for a simple payback of 2.4 years.
3. A GSA Green Proving Ground Program study conducted in 8 buildings with monitored receptacle control through market available plug strips found "Results underscored the effectiveness of schedule-based functionality, which reduce plug loads at workstations by 26%, even though advanced computer power management was already in place, and nearly 50% in printer room and kitchens." In the study buildings, receptacle loads averaged 21% of building energy use and monitored more than 295 devices over three different test periods to validate the findings. It found payback through timer scheduled control of kitchens of 0.7 years, printer rooms of 1.1 years and miscellaneous devices in 4.1 years. At workstations, the payback was 7.8 years.
4. A study done on "Office Space Plug Load Profiles and Energy Savings Interventions" at the University of Idaho and presented at the ACEEE summer Study in 2012 found that average savings of 0.60 kWh/SF Yr. with plug strip control interventions. This study provided guidance for utility programs to assist with development of plug load efficiency measures and was based on a more detailed report, "Plug Load Profiles" (Acker, B. et. al. 2012).
5. The DOE Better Buildings program issued a December 2015 "Decision Guides for Plug and Process Loads Controls" to help educate and guide decision processes for effective receptacle-based load control. It highlights that "Plug and Process Loads" account for 33% of the total energy consumed by commercial buildings. It sites seven decision strategies including that of Integrated plug load controls with other building systems as one of the largest for energy savings across most building types for whole-building retrofit and new construction categories.
6. A study performed "Advancing the Last Frontier – Reduction of Commercial Plug Loads" presented at the ACEEE summer study of 2016, indicated field study results demonstrating savings of 19% when deploying plug in control strategies in office workstation environments.

Cost Impact: The code change proposal will increase the cost of construction Costs estimated to be \$0.26/ft² for small office implementation and \$0.19/ft² for large office. Payback estimated at 4.2 years for small office buildings (10,000sqft) and 2.4 years for large office buildings (100,000sqft). Source: 2013 California Building Energy Efficiency Standards CASE report.

CE216-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

C405.10 Automatic Receptacle Control (Mandatory). The following shall ~~have be~~ automatically receptacle controls ~~for~~ complying with Section C405.10.1:

1. At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3. ~~Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.~~

This control shall function on **C405.10.1 Automatic receptacle control function**. Automatic receptacle controls shall comply with the following:

1. Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.
2. Shall be controlled by one of the following methods:
 - 2.1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft2 and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft.
 - 2.2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space.; or
 - 2.3. An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.
3. All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space.
4. Plug-in devices shall not comply.

Exceptions: ~~Automatic R receptacles controls are not required~~ for the following ~~shall not require an automatic control device:~~

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

Committee Reason: This is a nice solution and adds efficacy to another building system. the modification clarifies the original language in ICC format (Vote: 10-5).

Assembly Action:

None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE216-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: This proposal is a solution looking for a problem. This will cause all kinds of problems in an office setting. In many offices you cannot shut off the printers, especially large plotters. Many offices are also 24 hour facilities, and this proposal is counter productive. In the office where I work, there are entire floors that are touchdown work stations, they can be used by a variety of people and are used all day and night. Many offices are not your normal 8 to 5 schedule like years ago. In our office our phone is also based on the internet and if the receptacle it is plugged into the phone would shut down, this is not good for business. At the first sign of issues these devices will be overridden which meant it was a waste of money to add all the controls.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1837

Public Comment 2:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: Mandating that all projects that fall into the categories listed in this proposal utilized control receptacles does not work for all projects. There is a place for this type of requirement, and it should be a choice in the additional efficiency package. This is something that projects must think about to verify that the equipment that will be placed in these types of projects can function on a controlled receptacle situation. It doesn't do any good if what we have is an over abundant number of receptacles installed to compensate for the control receptacles, or what you have is the daisy chain effect of extension chord to power strip to extension chord to power strip.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1538

CE217-19 Part I

IECC: C202, C405.10 (New), C405.10.1 (New), TABLE C405.10.1 (New), C405.10.2 (New)

Proposed Change as Submitted

Proponents: Matt Frommer, Southwest Energy Efficiency Project, representing Southwest Energy Efficiency Project (mfrommer@swenergy.org); Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org); jim edelson, representing New Buildings Institute (jim@newbuildings.org); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org); Francesca Wahl (fwahl@tesla.com); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Add new definition as follows:

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an EVSE, and be located in close proximity to the proposed location of the EV parking spaces.

Add new text as follows:

C405.10. Electric Vehicle (EV) charging for new construction. New construction shall facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the NFPA 70.

C405.10.1. New commercial buildings. EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table C405.10.1. Where the calculation of percent served results in a fractional parking space, it shall be rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

TABLE C405.10.1.
EV READY SPACE AND EV CAPABLE SPACE REQUIREMENTS

Total Number of Parking Spaces	Minimum number of <i>EV Ready Spaces</i>	Minimum number of <i>EV Capable Spaces</i>
<u>1</u>	<u>1</u>	=
<u>2 – 10</u>	<u>2</u>	=
<u>11 – 15</u>	<u>2</u>	<u>3</u>
<u>16 – 19</u>	<u>2</u>	<u>4</u>
<u>21 - 25</u>	<u>2</u>	<u>5</u>
<u>26+</u>	<u>2</u>	<u>20% of total parking spaces</u>

C405.10.2. Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

Reason: In the United States, electric vehicle (EV) sales increased by 80 percent from 2017 to 2018 (1). According to a November 2018 forecast from the Edison Electric Institute, the number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in workplace and commercial buildings (2).

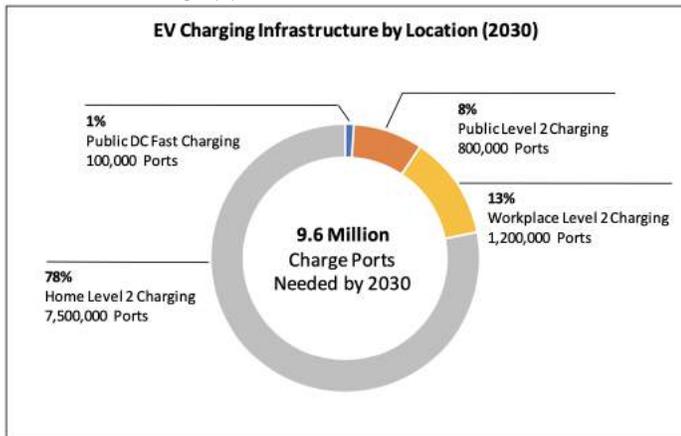


Figure 1. EV Charging Infrastructure in 2030 Based on EEI/IEI Forecast.

EVs provide significant economic benefits for consumers through fuel and maintenance cost savings, and have been identified as a key climate strategy to reduce GHG emissions from the U.S. transportation sector. The interest in EVs has grown alongside greater EV model availability and increased vehicle range. Every major auto manufacturer in the world has announced a plan to electrify a significant portion of their vehicle fleets over the next 3-5 years. Ford recently announced an \$11 billion investment to reach their goal of 40 EV models by 2022 (3). The goal for GM: 20 EV models by 2023 (4); for VW: 27 EV models by 2022 (5); for Toyota: 10 BEVs by the early 2020's (6); and similar goals for Volvo, Daimler, Nissan, BMW, and Fiat-Chrysler.

However, the lack of access to EV charging stations continues to be a critical barrier to EV adoption. In particular, there are significant logistical barriers for commercial building tenants to upgrade existing electrical infrastructure and install new EV charging stations.

A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. The installation of an EV charging station is made three to four times less expensive when the infrastructure is installed during the initial construction phase as opposed to retrofitting existing buildings to accommodate the new electrical equipment.

New commercial buildings are constructed to last for decades, and so it is critical that EV charging infrastructure is incorporated at the pre-construction stage to ensure that new buildings can accommodate the charging needs of future EV-owners.

Bibliography:

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 6. Kageyama, Yuri. "Toyota Planning 10 Purely Electric Vehicles by 2020s." USA Today. December 18, 2017. Accessed January 2019. <https://www.usatoday.com/story/money/cars/2017/12/18/toyota-planning-10-purely-electric-vehicles-2020-s/960486001/>.
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 9. "NFPA 70®." NFPA Reports - Fires in the United States. Accessed January 2019. <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>.

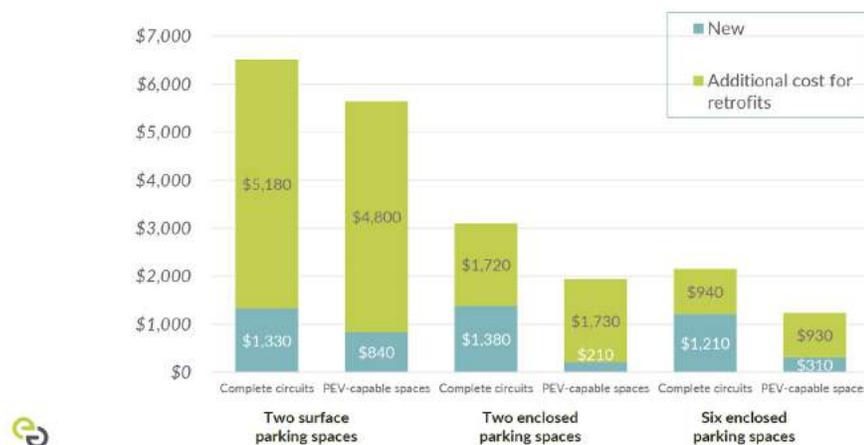
Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will increase the cost of initial construction, but provide long-term savings for EV owners through the avoided retrofit costs of installing EV charging infrastructure.

The chart below compares the cost of installing the necessary electrical infrastructure to support EV-Ready spaces (complete circuit) and an EV-Capable spaces (PEV-capable) at the time of new construction versus a building retrofit. In one example, the cost to retrofit an existing building with two EV-Capable spaces is \$5,640, and \$4,800 or 85 percent of that cost would be avoided if EV-Capable infrastructure was included during the initial construction of the parking lot. These additional retrofit costs typically include labor expenses for demolition, trenching and boring, balancing the circuits, and new permitting costs.

Why Adopt EV Infrastructure Building Codes?

Cost Savings Modeled for the City of Oakland



In April, 2018, the California Air Resources Board published a cost analysis for a proposed code change to increase the required percentage of EV-Capable spaces. (8)

“Avoided Retrofit Costs: Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated \$7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated \$8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 38,000 to 47,000 parking spaces with EV charging infrastructure beyond the current 3 percent requirement. If the proposed 10% requirement is not adopted, CARB staff assumed that every one of these parking spaces would need the basic EV charging infrastructure (raceway and panel capacity) to become EV Capable and support future installation of Level 2 charging stations. CARB staff estimates that the avoided retrofit costs range from \$272 million to \$386 million between 2020 and 2025.”

Public Hearing Results

Committee Action:

As Modified

Committee Modification: Electric Vehicle. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

EV READY SPACE. A designated parking space which is provided with one ~~40~~ 50-ampere, 208/240-volt dedicated branch circuit for a future dedicated Level 2 EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination, NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 208/240 or greater service. The circuit shall have no other outlets. The service panel shall include an over-current protective device and provide sufficient capacity and space to accommodate the circuit and over-current protective device point such as a receptacle, junction box, or an EVSE; and be located in close proximity to the proposed location of the EV parking spaces.

C405.10 Electric Vehicle (EV) charging for new construction (Mandatory). New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the NFPA 70.

C405.10.2. Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EVSEs ~~chargers~~. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

C405.10.1. New commercial buildings. EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table C405.10.1. Where the calculation of percent served results in a fractional parking space, it shall be rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

Committee Reason: This is a health and safety issue so people do not run power cords out their windows to power vehicles. The cost assessment was very modest. The modification clarified application (Vote: 12-3).

Assembly Action:

None

CE217-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.10 (New)

Proponents:

Craig Conner, representing self (craig.conner@mac.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

C405.10 Electric vehicle charging spaces. In new construction Group E, M, R-1 and R-2 buildings with 50 or more passenger vehicle parking spaces shall provide two EV Ready 50-ampere, 208/240-volt branch circuits per 50 passenger vehicle parking spaces. The number of spaces required shall be rounded up to the nearest even number.

The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY". The circuit shall terminate in a NEMA receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.

Exceptions:

1. Parking spaces and garage spaces intended exclusively for storage of vehicles for retail sale or vehicle service.
2. This requirement will be considered met if all spaces which are not EV Ready are separated from the meter by a public right-of-way.

Commenter's Reason: The general goal of CE2117 Part 1 make sense. However, there are multiple issues of CE217 Part 1

- 20% of the parking spaces for EVs is way too many. There are not nearly enough electric vehicles now or projected in the near term to justify 20% of the parking spaces.

- This applies to all use groups, even those unlikely to have many EVs.
- Wording is confusing. For example, having both "EV Ready and "EV Capable" could be confusing
- If there is only 1 or 2 spaces the table says all parking must be EV.

This comment

- lowers the percentage of EV ready parking spaces to 4% (2 per 50 is 4%).
- has no requirement for buildings with less than 50 parking spaces.
- specifies an even number of EV ready parking spaces because many commercial charging units are made for 2 cars per stations. The (future) charging station sets between two parking spaces with charging lines to both parking spaces.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This change will add costs.

Adding new EV capacity for charging during construction costs much less than retrofitting, as retrofitting often requires retrenching, rewiring or upgrades to electric panels.

Public Comment# 2161

Public Comment 2:

IECC®: APPENDIX CEV (New), CEV100 (New), 202 (New), CEV 101.1 (New), CEV 101.2 (New), TABLE CEV 101.2 (New), CEV 101.3. (New)

Proponents:

Margo Thompson, Newport Ventures, representing National Multifamily Housing Council (mthompson@newportventures.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

APPENDIX CEV **Electric Vehicle Charging Capability for New Construction**

CEV100 Definitions The following words and terms shall, for the purposes of this appendix, having the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

ELECTRIC VEHICLE. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 50-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the EVSE.

EV READY SPACE. A designated parking space which is provided with one 50-ampere, 208/240-volt dedicated branch circuit for a future dedicated Level 2 EVSE servicing *Electric Vehicles*. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 208/240 or greater service. The circuit shall have no other outlets. The service panel shall include an over-current protective device and provide sufficient capacity and space to accommodate the circuit and over-current protective device and be located in close proximity to the proposed location of the EV parking spaces.

~~G405-10-~~ **CEV 101.1 Electric Vehicle (EV) charging for new construction (Mandatory)**. New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the NFPA 70.

~~G405-10-1-~~ **CEV 101.2 New buildings**. *EV Ready Spaces* and *EV Capable Spaces* shall be provided in accordance with Table ~~G405-10-1-~~ **CEV 101.2**. Where the calculation of percent served results in a fractional parking space, it shall be rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

**TABLE ~~G405-10-1~~ CEV 101.2
EV READY SPACE AND EV CAPABLE SPACE REQUIREMENTS**

Total Number of Parking Spaces	Minimum number of EV Ready Spaces	Minimum number of <i>EV Capable Spaces</i>
1	1	-
2 – 10	2	-
11 – 15	2	3
16 – 19	2	4
21 - 25	2	5
26+	2	20% of total parking spaces

~~G405-10-2~~ CEV 101.3. Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EVSEs. Construction documents shall also provide information on amperage of future *EVSE*, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the *EVSE*.

Commenter's Reason: Reason: A report by the International Council on Clean Transportation found that there is wide variation in the prevalence of electric vehicles (EVs) on the road across the country. While there are large numbers of electric vehicles on the east and west coasts of the U.S., the vast majority of the country is not even close to a 2% market penetration of EVs. Requirements for EV charging capability and dedicated parking spaces should be left up to local jurisdictions, for instance, local planning and zoning boards which can tailor the requirements to the existing and anticipated conditions in their locale. Local factors vary significantly and include potential policies supporting EVs or emission reductions; utility integration issues which may or may not favor added EV charging, etc. While 20% EV capable parking spaces might be the right number in one city or town, it may be too few or too many for another. By moving these new provisions to an Appendix - rather than as part of the body of the Energy Code - a template is provided for jurisdictions to use and modify in a manner that they deem appropriate for their locale. It is important to support and encourage increased use of electric vehicles in order to reduce carbon emissions, but it must be done in a manner that suits local conditions rather than an across-the-board, one-size-fits-all mandate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The proposal As Submitted would increase the cost of construction - especially since adding 20% *EV Capable* parking spaces may not even be warranted. A typical multifamily building may have 500 parking spaces. The proposal would require 100 *EV capable* electric circuits and 4,000 amps minimum extra capacity in the panel box. Furthermore, space allotted for *EV capable* parking must be greater than that for standard parking spaces in order to allow for the charging post. A cost analysis performed by the National Multifamily Housing Council found that creating **four** *EV capable* charging stations would cost approximately \$5,000.

By moving the proposed language to an Appendix, this Public Comment does not increase or decrease the cost of construction. It allows local jurisdictions to develop policies related to Electric Vehicles that are practical and cost effective for their constituents.

Public Comment# 1553

Public Comment 3:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: This proposal is way to restrictive, the numbers are not rational. For small businesses the numbers would be in additional to accessible spaces. If an owner had room for 11 parking spaces in front of their building, 2 would need to be EV ready, 3 would need to be EV capable and 1 would need to be accessible. In some states the EV parking space also needs to be accessible. This leaves the owner with 8 spaces for everyone else to park, for the time until the other spaces are mandated, at that time there will be almost no parking left for non EV users, this is far to restrictive.

In a large building or shopping center, if the parking lot has 500 parking spaces which is mandated by local zoning codes. The parking lot would need 9 accessible parking spaces, 2 EV ready spaces and 100 EV capable spaces. While for a large parking field 2 EV ready spaces is much more reasonable, the 100 EV capable spaces is a huge waste of resources.

The proponent needs to come back with more reasonable numbers that work for all situations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to

Public Comment 4:

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests Disapprove

Commenter's Reason: A requirement to install electric vehicle charging stations should not be set in place in a minimum code. The intent of the IECC is "This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building". Installing electric vehicle charging stations does not deal with the building or conserving energy within the building. This type of proposal is better suited for a green code and not a minimum base code. This does not allow for innovation of new technology for other forms of transportation. This is a market driven application and should not be mandated.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The original code change will increase the cost of construction but the public comment if accepted will have no effect on the cost of construction because there will be no change to the code.

Public Comment 5:

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests Disapprove

Commenter's Reason: Promotion on electric vehicle charging infrastructure for vehicle market benefits is outside the scope and purpose of the IECC. The proposal does not address building energy conservation, which is the scope and purpose of IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

CE217-19 Part II

IECC: R202 (IRC N1101.6), R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New), Table R404.2.2 (IRC N1104.2.2) (New), R404.2.3 (IRC N1104.2.3) (New)

Proposed Change as Submitted

Proponents: Matt Frommer, Southwest Energy Efficiency Project, representing Southwest Energy Efficiency Project (mfrommer@swenergy.org); Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org); jim edelson, representing New Buildings Institute (jim@newbuildings.org); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Francesca Wahl (fwahl@tesla.com)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for *EVSE* servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an *EVSE*, and be located in close proximity to the proposed location of the EV parking spaces.

Add new text as follows:

R404.2 (IRC N1104.2) Electric Vehicle (EV) charging for new construction. New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the *National Electrical Code (NFPA 70)*.

R404.2.1 (IRC N1104.2.1) One- to two-family dwellings and townhouses. For each dwelling unit, provide at least one *EV Ready Space*. The branch circuit shall be identified as "EV Ready" in the service panel or subpanel directory, and the termination location shall be marked as "EV Ready".

Exception: *EV Ready Spaces* are not required where no parking spaces are provided.

R404.2.2 (IRC N1104.2.2) Multifamily dwellings (three or more units). *EV Ready Spaces* and *EV Capable Spaces* shall be provided in accordance with Table R404.2.2. Where the calculation of percent served results in a fractional parking space, it shall round up to the next whole number. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

Table R404.2.2 (IRC N1104.2.2)
EV Ready Space and EV Capable Space requirements.

Total Number of Parking Spaces	Minimum number of EV Ready Spaces	Minimum number of EV Capable Spaces
<u>1</u>	<u>1</u>	=
<u>2 – 10</u>	<u>2</u>	=
<u>11 – 15</u>	<u>2</u>	<u>3</u>
<u>16 – 19</u>	<u>2</u>	<u>4</u>
<u>21 - 25</u>	<u>2</u>	<u>5</u>
<u>26+</u>	<u>2</u>	<u>20% of total parking spaces</u>

R404.2.3 (IRC N1104.2.3) Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

Reason: In the United States, electric vehicle (EV) sales increased by 80 percent from 2017 to 2018 (1). According to a November 2018 forecast from the Edison Electric Institute, the number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in workplace and commercial buildings (2).

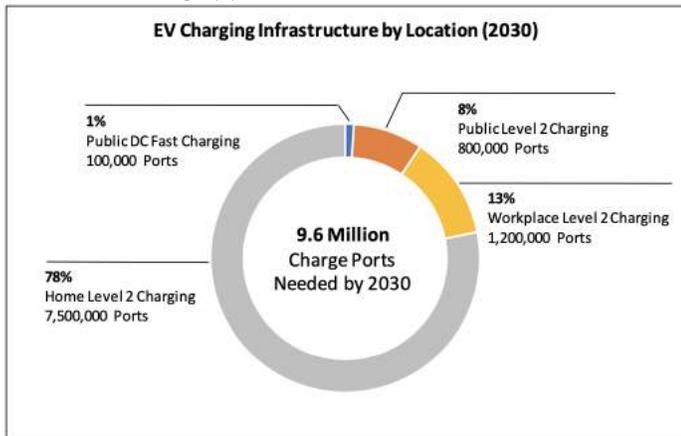


Figure 1. EV Charging Infrastructure in 2030 Based on EEI/IEI Forecast.

EVs provide significant economic benefits for consumers through fuel and maintenance cost savings, and have been identified as a key climate strategy to reduce GHG emissions from the U.S. transportation sector. The interest in EVs has grown alongside greater EV model availability and increased vehicle range. Every major auto manufacturer in the world has announced a plan to electrify a significant portion of their vehicle fleets over the next 3-5 years. Ford recently announced an \$11 billion investment to reach their goal of 40 EV models by 2022 (3). The goal for GM: 20 EV models by 2023 (4); for VW: 27 EV models by 2022 (5); for Toyota: 10 BEVs by the early 2020's (6); and similar goals for Volvo, Daimler, Nissan, BMW, and Fiat-Chrysler.

However, the lack of access to EV charging stations continues to be a critical barrier to EV adoption. In particular, there are significant logistical barriers for commercial building tenants to upgrade existing electrical infrastructure and install new EV charging stations.

A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. The installation of an EV charging station is made three to four times less expensive when the infrastructure is installed during the initial construction phase as opposed to retrofitting existing buildings to accommodate the new electrical equipment.

New commercial buildings are constructed to last for decades, and so it is critical that EV charging infrastructure is incorporated at the pre-construction stage to ensure that new buildings can accommodate the charging needs of future EV-owners.

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- Accessed January 2019. http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI_EV_Forecast_Report_Nov2018.pdf.
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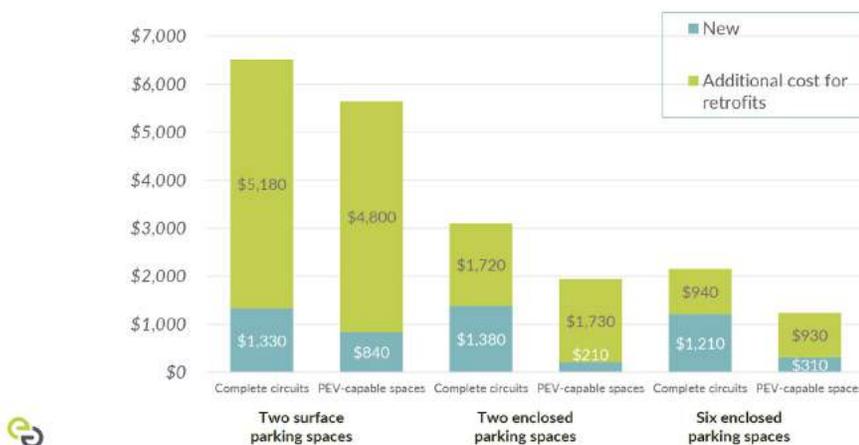
Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will increase the cost of initial construction, but provide long-term savings for EV owners through the avoided retrofit costs of installing EV charging infrastructure.

The chart below compares the cost of installing the necessary electrical infrastructure to support EV-Ready spaces (complete circuit) and an EV-Capable spaces (PEV-capable) at the time of new construction versus a building retrofit. In one example, the cost to retrofit an existing building with two EV-Capable spaces is \$5,640, and \$4,800 or 85 percent of that cost would be avoided if EV-Capable infrastructure was included during the initial construction of the parking lot. These additional retrofit costs typically include labor expenses for demolition, trenching and boring, balancing the circuits, and new permitting costs.

Why Adopt EV Infrastructure Building Codes?

Cost Savings Modeled for the City of Oakland



In April, 2018, the California Air Resources Board published a cost analysis for a proposed code change to increase the required percentage of EV-Capable spaces. (8)

“Avoided Retrofit Costs: Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated \$7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated \$8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 38,000 to 47,000 parking spaces with EV charging infrastructure beyond the current 3 percent requirement. If the proposed 10% requirement is not adopted, CARB staff assumed that every one of these parking spaces would need the basic EV charging infrastructure (raceway and panel capacity) to become EV Capable and support future installation of Level 2 charging stations. CARB staff estimates that the avoided retrofit costs range from \$272 million to \$386 million between 2020 and 2025.”

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: It may be commendable but there is no demonstration of energy savings or relationship to building energy efficiency. It does not belong in energy codes (Vote: 8-3).

Assembly Action:

None

CE217-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: 202 (New), R404.2.1 (IRC N1104.2.1) (New)

Proponents:

Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Matthew Frommer, representing Southwest Energy Efficiency Project (mfrommer@swenergy.org); Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the EVSE. A designated parking space which is provided with a listed raceway capable of accommodating a 40-ampere minimum 208/240-volt dedicated branch circuit for each future EV Ready parking space. Raceways shall not be less than trade size 1 (nominal 1-inch inside diameter). Raceways shall originate at the main service or subpanel and shall terminate into a listed cabinet, box, or enclosure in close proximity to the proposed location of the EV Capable parking spaces. Raceways are required to be continuous at enclosed, inaccessible or concealed areas and spaces. The service panel and/or subpanel shall provide capacity to install a 40-ampere minimum 208/240-volt dedicated branch circuit and space(s) reserved to permit installation of a branch circuit overprotection device.

EV READY SPACE. A designated parking space which is provided with one minimum 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an EVSE, and be located in close proximity to the proposed location of the EV Ready parking spaces.

R404.2.1 (IRC N1104.2.1) One- to two-family dwellings and townhouses. For each dwelling unit, provide at least one *EV Ready Space*. The branch circuit shall be identified as “EV Ready” in the service panel or subpanel directory, and the termination location shall be marked as “EV Ready”.

Exception Exceptions:

1. EV Ready Spaces are not required where no parking spaces are provided.
2. This section does not apply to parking spaces used exclusively for trucks or delivery vehicles.

Commenter's Reason:

This public comment adds a definition, improves the requirement specification for EV Capable parking spaces, and clarifies that parking spaces used for trucks and delivery vehicles would not be affected. The public comment also addresses the positive effect the proposal would have on total household energy spending.

In the United States, electric vehicle (EV) sales increased by 80 percent from 2017 to 2018 (1). According to a November 2018 forecast from the Edison Electric Institute, the number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in single and multi-family residential buildings (2).

EVs provide significant economic benefits for consumers through fuel and maintenance cost savings, and have been identified as a key climate strategy to reduce GHG emissions from the U.S. transportation sector. The interest in EVs has grown alongside greater EV model availability and increased vehicle range. Every major auto manufacturer in the world has announced a plan to electrify a significant portion of their vehicle fleets over the next 3-5 years. Ford recently announced an \$11 billion investment to reach their goal of 40 EV models by 2022 (3). The goal for GM: 20 EV models by 2023 (4); for VW: 27 EV models by 2022 (5); for Toyota: 10 BEVs by the early 2020's (6); and similar goals for Volvo, Daimler, Nissan, BMW, and Fiat-Chrysler.

A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. The installation of an EV charging station is made three to four times less expensive when the infrastructure is installed during the initial construction phase as opposed to retrofitting existing buildings to accommodate the new electrical equipment. New residential buildings are constructed to last for decades, and so it is critical that EV charging infrastructure is incorporated at the preconstruction stage to ensure that new buildings can accommodate the charging needs of future EV-owners.

Increased adoption of EVs will have a positive effect on overall U.S. household energy spending and carbon emissions. In terms of energy savings, EV fuel economy is, on average, more than three times more efficient than conventional gasoline-fueled counterparts. Even when compared over the full lifecycle of fuel production and use, the average EV consumes less than half the energy per vehicle mile traveled. (10) (11) NRDC and EPRI found that if 50 percent of personal vehicle miles traveled were powered by electricity in 2050, the U.S. would realize annual emissions reductions of 550 million metric tons of carbon dioxide. (12) The code change in place by the time adoption rates are expected to accelerate would facilitate adoption of EVs and therefore lead to more efficient energy consumption and lower household carbon emissions.

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Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal will increase the cost of initial construction, but provide long-term savings for EV owners through the avoided retrofit costs of installing EV charging infrastructure.

One- and two- family dwellings: Additional costs include the price and labor associated with the installation of one 40-ampere, 208/240-volt dedicated branch circuit and a circuit terminating in a receptacle, junction box, or EVSE. The proposed code will allow current and future EV-owners to avoid the cost of electrical equipment upgrades, demolition, and permitting for future retrofits.

Multi-family residential (3 or more units): In one example, the cost estimate to retrofit an existing building with two EV-Capable spaces is \$5,640, and \$4,800 or 85 percent of that cost would be avoided if EV-Capable infrastructure was included during the initial construction of the parking lot. These additional retrofit costs typically include labor expenses for demolition, trenching and boring, balancing the circuits, and new permitting costs.

In April 2018, the California Air Resources Board published a cost analysis for a proposed code change to increase the required percentage of EV-Capable spaces. (8) "Avoided Retrofit Costs: Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated \$7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated \$8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 38,000 to 47,000 parking spaces with EV charging infrastructure beyond the current 3 percent requirement. If the proposed 10% requirement is not adopted, CARB staff assumed that every one of these parking spaces would need the basic EV charging infrastructure (raceway and panel capacity) to become EV Capable and support future installation of Level 2 charging stations. CARB staff estimates that the avoided retrofit costs range from \$272 million to \$386 million between 2020 and 2025."

Public Comment# 1603

Public Comment 2:

IECC®: 202 (New), Table R404.2.2 (IRC N1104.2.2) (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum ~~40~~ 50-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.

EV READY SPACE. A designated parking space which is provided with one ~~40~~ 50-ampere, 208/240-volt dedicated branch circuit for a future dedicated Level 2 EVSE servicing Electric Vehicles. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or suitable electrical connector rated for 208/240 Volt or greater service. The circuit shall have no other outlets ~~suitable termination point such as a receptacle, junction box, or an EVSE~~, and be located in close proximity to the proposed location of the EV parking spaces.

Table R404.2.2 (IRC N1104.2.2)
EV Ready Space and EV Capable Space requirements.

Total Number of Parking Spaces	Minimum number of EV Ready Spaces	Minimum number of EV Capable Spaces
1	1	-
2 – 10	2 <u>1</u>	-
11 – 15	2 <u>1</u>	3 <u>2</u>
16 – 19	2 <u>1</u>	4 <u>2</u>
21 - 25	2 <u>1</u>	5 <u>3</u>
26+	2	20 <u>10%</u> of total parking spaces

Committer's Reason: This modification will improve the proposed definitions and have language that is consistent with the language approved for CE 217, Part I.

This modification will also reduce the costs of this proposal compared to the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The installation of EV charging infrastructure will increase construction costs, but reduce transportation energy costs for vehicle owners.

Public Comment# 1350

Public Comment 3:

Proponents:

Tim Ryan, International Association of Building Officials, representing IABO

requests Disapprove

Committer's Reason: The International Association of Building Officials is opposed to this proposed change as it goes beyond the scope and intent of the ICC Codes, including the IECC. This provision does not support energy efficiency of buildings but conserves energy while providing convenience to owners of electric vehicles. The primary supporting testimony from proponents of this change was based on the expectation of increased car sales; that certain major cities have adopted similar provisions for their respective jurisdictions; and to address forward thinking. The testimony indicates that these types of requirements tend to be more market driven and are political issues which should be addressed by local and state governance bodies and not by model building codes. Such requirements are more appropriate within land usage and zoning regulations. While the proponents recognized several major jurisdictions that have adopted such provisions, it should be recognized that not all jurisdictions agree with such provisions and have considered this issue a private business issue. Therefore, IABO is recommending disapproval of CE217-19 part II

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1832

CE218-19

IECC: C406, C406.1, TABLE C406.1(1) (New), TABLE C406.1(12) (New), TABLE C406.1(3) (New), TABLE C406.1(4) (New), TABLE C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.5, C406.5.1 (New), C406.5.2 (New), C406.7 (New), C406.7, C406.7.1, C406.7.3 (New), C406.7.4 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

SECTION C406 ADDITIONAL EFFICIENCY REQUIREMENTS PACKAGE OPTIONS

C406.1 Requirements- Additional energy efficiency credit requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Alternatively, credits shall be calculated in accordance with the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Add new text as follows:

TABLE C406.1(1)
Additional Energy Efficiency Credits for Group B Occupancy

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	1	NA	NA	1	1	NA	1									
C406 .2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	1	NA	NA	2	1	1	2	2	NA	1						
C406 .2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406 .3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406 .5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406 .6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406 .7.3: Eff fossil fuel SWH ^b	NA	NA	NA	NA													
C406 .7.4: Heat Pump SWH ^b	NA	NA	NA	NA													
C406 .8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406 .9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

TABLE C406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3: Reduced Light Power	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

TABLE C406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406 .2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406 .3: Reduced Light Power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406 .6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA													
C406 .7.2: Recovered/Renew SWH ^a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH ^a	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH ^a	NA	1	NA	NA	1	1	NA	1	1	1	1						
C406 .8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406 .9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

a. For schools with showers or full service kitchens

TABLE C406.1(4)
Additional Energy Efficiency Credits for Group M Occupancy

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3: Reduced Light Power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA													
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

TABLE C406.1(5)
Additional Energy Efficiency Credits for Other^a Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406 .2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406 .2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406 .3: Reduced Light Power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egv.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406 .7.2: Recovered/Renew SWH ^b	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH ^b	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH ^b	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406 .9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

- a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M
- b. For occupancy groups listed in C406.7.1

Revise as follows:

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options from Tables C406.1(1) through C406.1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. ~~Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance. Where the entire building complies using credits from Section C406.5, C406.8 or C406.9, tenant spaces within the building shall be deemed to comply with this section.~~

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. ~~Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. 9) and Variable refrigerant flow systems shall exceed~~ listed in the energy efficiency provisions of ~~ANSI/~~ASHRAE/IESNA 90.1 by 10 percent, in accordance with Sections C406.2.1, C406.2, C406.2.3 or C406.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2 or C406.2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7-9) ~~and Variable refrigerant flow systems~~ not listed in the energy efficiency provisions of ASHRAE/IESNA 90.1 shall be limited to 10 percent of the total building system capacity for heating equipment where selecting Section C406.2.1 or C406.2.3 and cooling equipment where selecting Section C406.2.2 or C406.2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.5 On-site renewable energy. Buildings shall comply with Section C406.5.1 or C406.5.2. ~~The total minimum ratings of on-site renewable energy systems shall be one of the following:~~

1. Not less than 1.71 Btu/h per square foot (5.4 W/m²) or 0.50 watts per square foot (5.4 W/m²) of conditioned floor area.
2. Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Add new text as follows:

C406.5.1 Basic renewable credit. The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2, shall be one of the following:

1. Not less than 0.86 Btu/h per square foot (2.7 W/m²) or 0.25 watts per square foot (2.7 W/m²) of conditioned floor area.
2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

C406.5.2 Enhanced Renewable Credits. Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406.5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$$AEEC_{RRa} = AEEC_{2.5} \times RRa / RR1 \text{ (Equation 4-13)}$$

Where:

$AEEC_{RRa}$ = C406.5.2 additional energy efficiency credits

RRa = actual total minimum ratings of on-site renewable energy systems in Btu/h, watts per square foot or W/m²

$RR1$ = minimum ratings of on-site renewable energy systems required by C406.5.1(1) in Btu/h, watts per square foot or W/m²

$AEEC_{2.5}$ = C406.5.1 credits from Tables C406.1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Section C406.7.1 and Section C406.7.2, C406.7.3 or C406.7.4.

Revise as follows:

C406.7 C406.7.1 Reduced energy use in service water heating- Building Type Buildings shall be of the following types to use this compliance method. To qualify for this credit, the building shall contain one of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups:

1. Group R-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. Group R-2.
6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

C406.7.1 C406.7.2 Load fraction- Recovered or renewable water heating The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~ 30 percent of the building's annual hot water requirements, or sized to provide ~~40~~ 70 percent of the building's annual hot water requirements if the building ~~shall otherwise be required to~~ comply with Section C403.9.5:

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. On-site renewable energy water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

Reason: The C406 Option Packages was introduced into the IECC in 2012 as part of the prescriptive method to achieve an additional 4% energy savings over the prescriptive requirements of the code. The original proposal included three additional options (reduced lighting power density, increased HVAC efficiency and renewables). The 2018 IECC now has eight options to select from. In 2018, PNNL performed an analysis to determine the energy savings potential for each of the eight options and found significant savings differences.

How does the proposed measure compare to what's required in current codes?

The current additional efficiency package options are all considered equal in the 2018 IECC, and any one item must be selected to comply with the extra efficiency provision. However, there is a great deal of variation in the energy savings, as shown in Figure 1.

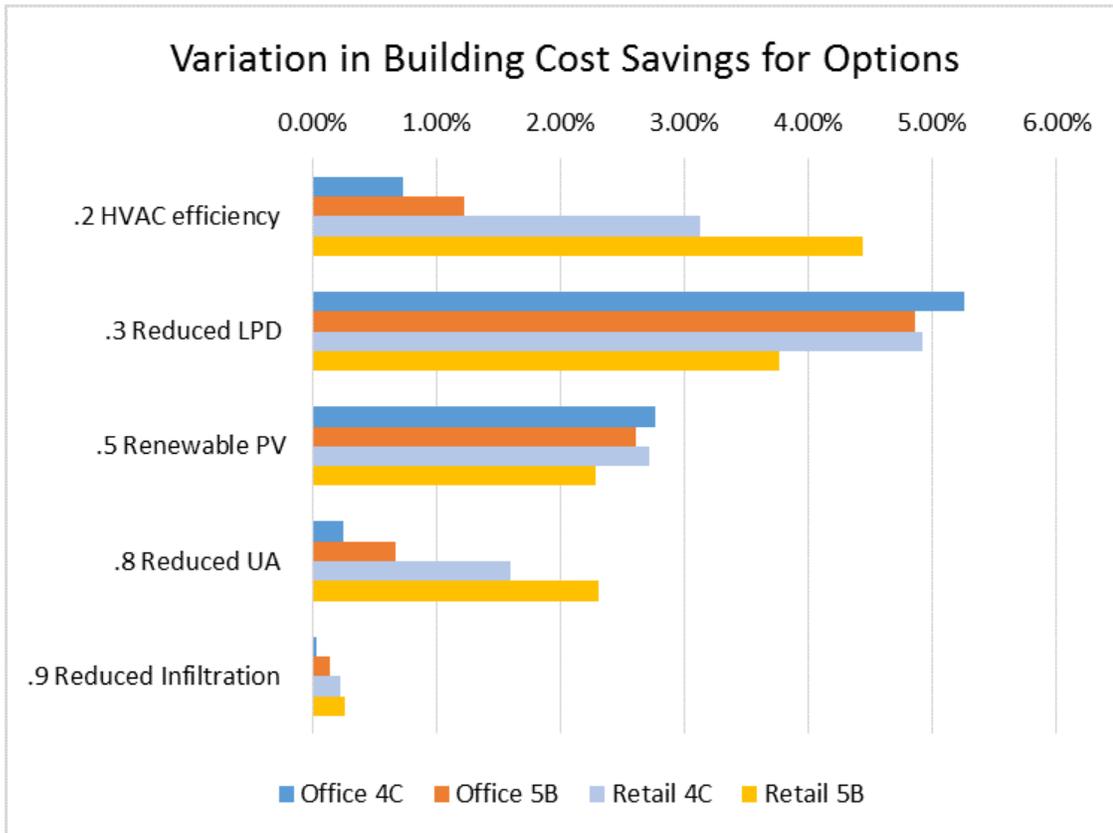


Figure 1

To address this issue PNNL developed a credits based option that provides equity across the efficiency measure options. The analysis is presented in their technical brief “Relative Credits for Extra Efficiency Measures” available at:

<https://www.osti.gov/servlets/purl/1490280>

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370rev.1.pdf

Technical Analysis

The technical analysis was conducted as follows:

Prototype models are used in the analysis. Their development, and associated climate locations, are described in detail in the quantitative determination[1] and are available for download.[2] Four building prototypes were used to capture the difference between building types:

- Medium office
- Primary School
- Mid-rise Apartment
- Stand Alone Retail

EnergyPlus™ was used to evaluate each measure in the four prototypes in all U.S. climate zones, except in cases where there is not a strong

interaction with building HVAC systems, where standard engineering calculations were used. This applies to service hot water and renewable energy. Dedicated outdoor air systems (DOAS) savings were estimated rather than modeled, as discussed in the “Relative Credits for Extra Efficiency Measures.”

Using average annual commercial energy prices, cost savings for each measure are calculated as a percentage of building total annual energy cost.

The cost percentages are converted to credit points, with the goal of not being exactly equivalent, but to provide approximate relative equivalency between measures. One point is assigned for each 0.25% of building energy cost savings.

Extra efficiency measures save energy by reducing energy use directly or reducing the heating or cooling loads in the building, resulting in lower HVAC energy use. The measure would require different items to be added to construction, depending on the combination of credits selected. The requirements for each measure are discussed under the individual items.

Why is an energy efficiency credit assignment method superior to other approaches?

The extra efficiency credit approach allows for designer and builder flexibility. While it is slightly more complicated to select multiple items and add up points, in many cases credit would be given for measures that are often included in buildings. Furthermore, using points rather than “just pick one” puts the options on more of a level consideration and better accounts for the impact of climate.

The climate zone impact is fairly broad, especially for cooling efficiency and building envelope measures. The spread is also broad for lighting reduction and plug load controls, as the reduced heat load must be made up by the heating system in colder climates, while in warmer climates there is added savings in the cooling system. Assigning the points relative to building energy cost savings and climate zone will reward savings measures appropriate to the location of the building, and more fairly across measures.

[1] Halverson M, M Rosenberg, W Wang, J Zhang, V Mendon, R Athalye, Y Xie, R Hart, and S Goel. 2014. *ANSI/ASHRAE/IES Standard 90.1-2013 Determination: Quantitative Analysis*. Pacific Northwest National Laboratory, Richland, WA.

https://www.energycodes.gov/sites/default/files/documents/901-2013_finalCommercialDeterminationQuantitativeAnalysis_TSD.pdf.

[2] Download from http://www.energycodes.gov/development/commercial/90.1_models.

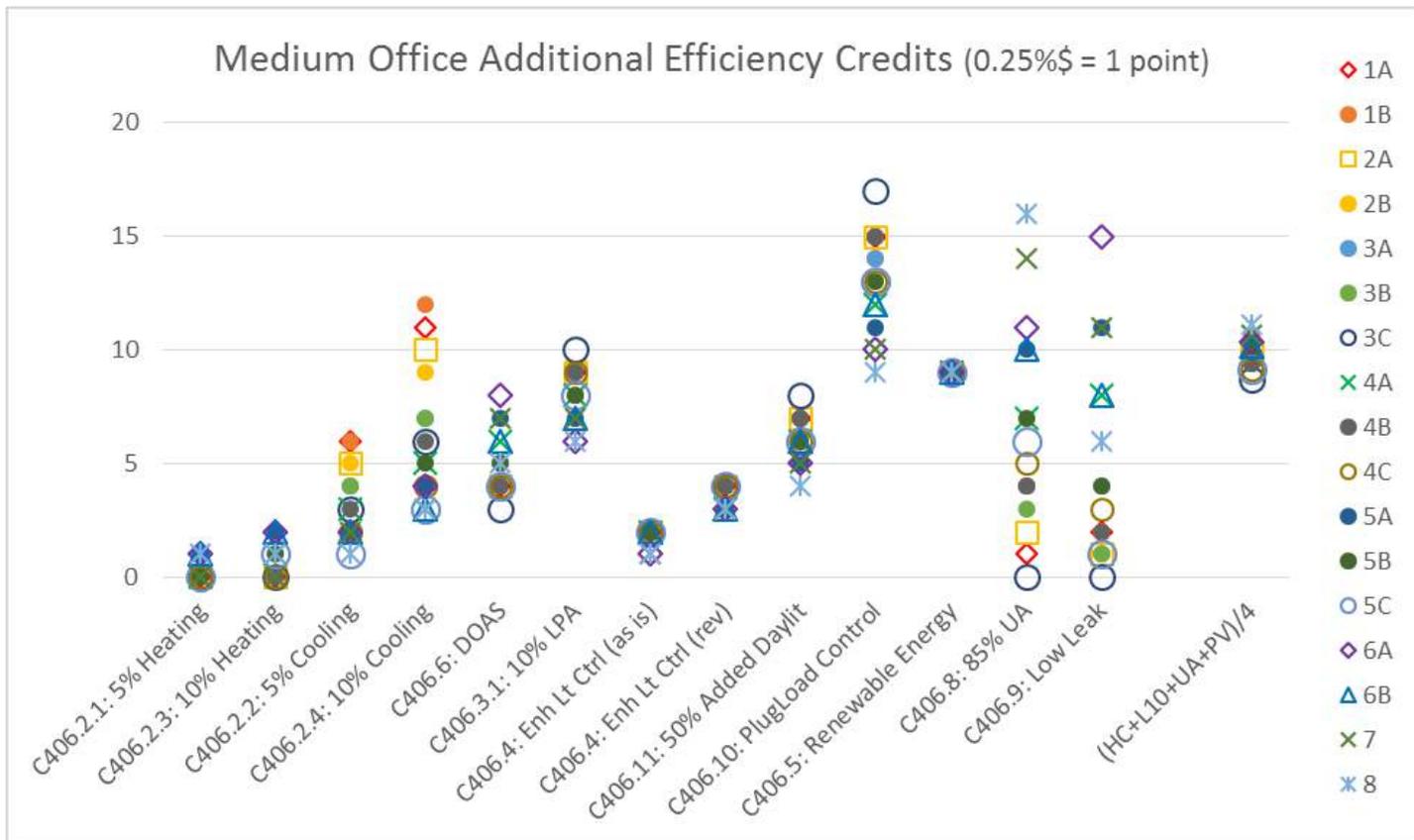


Figure 2

The points resulting from averaging four typical C406 measures (10 % HVAC, 10 % LPA, Renewable and 85% UA) are shown as the last item on the right side of Figure 2. These four average around 10 points across climate zones, while lighting power allowance—a popular option selection—averages around 8 points across climate zones. Selecting 10 points or 2.5% savings of building energy cost as the target of a point-based system makes sense as being slightly ahead or roughly equal to the approach followed in the 2018 IECC.

What strategies are considered to minimize compliance burdens?

To achieve savings from a combination of multiple measures under the 2018 IECC, the only recourse is to follow the performance path that requires a building model. Having a simple table of points for measures in different building types and climate zones bypasses the need for full performance modeling, which can be expensive relative to savings for smaller buildings. The end result is a performance-based approach that can be applied with the simplicity of a prescriptive approach.

Are there existing codes and standards that take a similar approach?

The outlined approach is based on the structure currently employed in the IECC for commercial buildings. It just shifts from a “pick one” approach to one that selects adequate measures from the options to meet a required point level. It is also similar to packages of measures that have been utilized in both residential and commercial energy codes, particularly in the Pacific Northwest. The Washington code has successfully used such a structure to balance energy performance, design flexibility, and evolving technologies.

The existing measures were modified to better fit within the credits option and to provide more flexibility.

More efficient HVAC heating performance (C406 .2) There has been industry feedback that it is difficult to comply with the 10 % increase in efficiency for the More Efficient HVAC Option because both the heating and cooling equipment must comply. The credits option allows either heating or cooling or both to comply. This measure would be modified to provide separate credits for the following:

- Medium efficiency HVAC heating performance (C406 .2.1) is a 5% improvement in efficiency over the existing minimum requirement.
- Medium efficiency HVAC cooling performance (C406 .2.2) is a 5% improvement in efficiency over the existing minimum requirement.
- High Efficiency HVAC heating performance (C406 .2.3) is a 10 % improvement in efficiency over the existing minimum requirement.

– High Efficiency HVAC cooling performance (C406 .2.4) is a 10 % improvement in efficiency over the existing minimum requirement

Note: If equipment efficiency tables for VRF or other items are added by another proposal, then remove the reference to the ASHRAE 90.1 tables and adjust the table number reference range to include all HVAC equipment tables.

– **C 40 6.5 On-site renewable energy.** The onsite renewable energy credit has been modified to allow for additional credit from increased system size over the base level requirement for this credit.

– **C 40 6.7.1 Reduced energy use in service water heating.** The water heating option allows for credit for high efficiency gas and electric water heaters in addition to heat recovery.

Note: Tables C406.1(1) through C406.1(5) include entries for climate zones 1A through 8. Should climate zones 0A and 0B be added to the IECC, use values for 1A in 0A and values for 1B in 0B.

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Hart R and J Zhang. 2018. *Cost-effectiveness Analysis of Hi-rise Residential Building Air Leakage Testing*. <https://www.energycodes.gov/sites/default/files/documents/TBD.pdf>.

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<http://buildingconnections.seattle.gov/2012/03/01/air-barriers-and-pressure-testing/>

Wiss J. 2014. *ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings*. Elstner Associates, Inc. for ASHRAE. <https://www.ashrae.org/resources--publications/periodicals/enewsletters/esociety/2014-12-10-articles/completed-research-december-2014>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. There is not expected to be an increased cost, as several of the evaluated options are included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

CE218-19

Public Hearing Results

Errata: This proposal includes no errata
Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. ~~Alternatively, credits shall be calculated in accordance with the relevant subsection of C406.~~ Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Portions of table not shown remain unchanged.

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.4: Digital Lt Ctrl	NA																

C406.4: Digital Lt Ctrl	3	3	4	3	4	3	4	4	4	3	3	3	3	4	4	3	3
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Committee Reason: This does a good job of weighting value across climate zones and is long overdue. This creates a new middle path for those that do not have a design team giving them a smart approach without expensive modeling. Provide a UA benefit in an appropriate location. This is a balancing of an unbalanced set of requirements for energy efficiency. The modifications move a sentence within charging language and brings in credit for a well liked requirement (Vote: 13-2).

Assembly Action: **None**

CE218-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.1 (New), C406.7.3 (New), C406.7.4 (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% Cooling	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% Cooling	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3.1: 10% LPA	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406.4: Digital Lt Ctrl	NA																
C406.5: Renewable	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406.6: DOAS	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.4.2: SWH HR	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.2.3: SWH NG eff	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.3.4: SWH HP	<u>6.11</u>	<u>5.10</u>	<u>5.11</u>	<u>5.11</u>	<u>5.11</u>	<u>5.11</u>	<u>5.13</u>	<u>5.12</u>	<u>5.12</u>	<u>5.13</u>	<u>5.11</u>	<u>5.11</u>	<u>5.13</u>	<u>5.11</u>	<u>5.11</u>	<u>5.11</u>	<u>5.10</u>
C406.8: 85% UA	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Low Leak	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

C406.1

Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% Cooling	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10% Cooling	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3.1: 10% LPA	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406.6: DOAS	NA																
C406.7.4.2: SWH HR*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.7.2.3: SWH NG eff*	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406.7.3.4: SWH HPWH*	NA																
	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
C406.8: 85% UA	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Low Leak	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

* for schools with full service kitchens or showers

C406.1

Table C406.1(5) Additional Energy Efficiency Credits for Other* Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% Cooling	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10% Cooling	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3.1: 10% LPA	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406.6: DOAS	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.4.2: SWH HR**	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.4.3: SWH FF eff**	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4.4: SWH HPWH**	6.11	5.10	5.11	5.11	5.11	5.11	5.13	5.12	5.12	5.13	5.11	5.11	5.13	5.11	5.11	5.11	5.10
C406.8: 85% UA	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Low Leak Env	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

* Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

** for occupancy groups listed in C406.7.1

C406.7.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0.95 EF and shall meet 75 percent of the water heating capacity. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater. Where electric resistance water heaters are allowed, ~~at 75 percent of service hot water system heating requirements capacity shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.~~

Commenter's Reason: In the initial analysis, a gas baseline was used relative to installing a heat pump water heater system. In many cases, especially in apartments, individual electric resistance heaters are the typical baseline. A review of the CBECS data base and AHRI water heater shipment data finds that electric and gas water heaters are about evenly split in current market share. To account for this, the analysis baseline was shifted to 50% electric resistance water heaters and 50% standard gas water heaters. This resulted in an increase in credits allowed for the heat pump water heaters.

The restriction on using conditioned space air is also removed as this has been shown to not be of concern in commercial spaces with large internal heat gains or in residential settings based on actual testing in the PNNL lab homes.

For both C406.7.3 and C406.7.4 the high efficiency heating requirement is required to be 75% of service water heating capacity, as some requirements are better met with other options, such as dishwasher booster heaters, point of use or limited use water heaters like those serving a janitorial sink or public restroom.

In addition, numeric references to the appropriate heat pump water heater sections are corrected.

Bibliography: https://labhomes.pnnl.gov/documents/HPWH_SpaceConditioning_Report_PNNL_23526_FINAL.pdf
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22642.pdf

https://labhomes.pnnl.gov/documents/HPWH_BAreview_PNNL-SA-95180.pdf

<https://aceee.org/files/proceedings/2014/data/papers/1-1203.pdf>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. There is not expected to be an increased cost, as several of the evaluated options are included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations.

amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

Public Comment 2:

IECC®: C406.1 (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Exceptions:

1. Buildings in Utility and Miscellaneous Group U
2. Buildings in Storage Group S, Factory Group F, High-Hazard Group H, Low-energy buildings as defined in C402.1.1, and Equipment buildings as defined in C402.1.2, that achieve a total of 7 credits.
3. Buildings in Residential and Institutional Groups R and I in climate zones 3C, 4B, 4C, 5C that achieve a total of 7 credits

Commenter's Reason: This Public Comment addresses concerns raised by committee members and others by adding exceptions to Section 406.1 to address low energy use buildings and multi-family, hotel and institutional buildings.

The first exception eliminates additional efficiency requirements for the miscellaneous group that have low energy use and little opportunity for additional energy savings.

The second and third exceptions reduce the additional efficiency credits required from 10 to 7 for two situations:

- Warehouses, industrial buildings, equipment, and low energy buildings. These buildings could now easily meet the 7 point credit requirement with only a 10% lighting power reduction, which is readily available with high-efficacy lighting fixtures.

- Apartment, hotel, and institutional buildings in climate zones where credits available are limited. As with most other buildings, a combination of measures would be required, but this would level the playing field across climate zones for meeting the credit requirement.

For the group R & I buildings, the exceptions mean that of five paths identified with two to three items, the exceptions in this PC would qualify all climate zones for those paths, except for climate zone 3C in California that has four paths. There are an additional four paths with four out of eight items that would qualify outside of 3C. *Note that if the separate public comment increasing points for heat pump water heaters passes, fewer items may be required when heat pump water heaters are included.* Examples of complying combinations with two to three options include:

- Natural Gas condenser water heating plus 10% cooling efficiency improvement
- Renewable energy plus DOAS ventilation with energy recovery
- Heat pump water heating; 10% cooling efficiency improvement; lighting efficacy
- Building envelope improvement; leak reduction; DOAS ventilation
- Heat pump water heating; 15% common area light reduction; lighting efficacy

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The Public Comment exempts certain buildings that were currently included in the original CE218 proposal (Utility and Miscellaneous Group U) and also requires fewer credits for buildings lower energy use buildings. The public comment also requires multifamily to select fewer credits (7 instead of 10) in specific climate zones that will reduce the overall cost of compliance with CE218..

Public Comment# 2006

Public Comment 3:

IECC@: Table C406.1(1) (New), Table C406.1(2) (New), Table C406.1(3) (New), Table C406.1(4) (New), Table C406.1(5) (New), C406.5.1 (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

Table C406.1(1)
Additional Energy Efficiency Credits for Group B Occupants

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	1	NA	NA	1	1	NA	1									
C406.2.2: 5% Cooling	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10% Heating	NA	1	NA	NA	2	1	1	2	2	NA	1						
C406.2.4: 10% Cooling	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3.1: 10% LPA	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5: Renewable	9.6	9.5	9.6	9.7	9.6	9.7	9.7	9.5	9.7	9.5	9.5	9.6	9.5	9.4	9.5	9.4	9.3
C406.6: DOAS	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.1: SWH HR	NA																
C406.7.2: SWH NG eff	NA																
C406.7.3: SWH HP	NA																
C406.8: 85% UA	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Low Leak	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

Table C406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% Cooling	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% Cooling	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3.1: 10% LPA	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406.4: Digital Lt Ctrl	NA																
C406.5: Renewable	8.5	8.5	8.5	8.5	7.5	8.6	8.6	7.4	7.5	7.4	7.4	7.4	7.4	7.3	7.4	7.3	7.2
C406.6: DOAS	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.1: SWH HR	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.2: SWH NG eff	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.3: SWH HP	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: 85% UA	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Low Leak	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

**Table C406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% Cooling	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10% Cooling	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3.1: 10% LPA	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	6.4	6.4	6.4	6.5	6.4	6.5	6.5	6.4	6.5	6.4	6.4	6.4	6.4	6.4	6.4	5.3	5.2
C406.6: DOAS	NA																
C406.7.1: SWH HR*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.7.2: SWH NG eff*	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406.7.3: SWH HPWH*	NA	1	NA	NA	1	1	NA	1	1	1	1						
C406.8: 85% UA	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Low Leak	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

* for schools with full service kitchens or showers

**Table C406.1(4)
Additional Energy Efficiency Credits for Group M Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406.2.2: 5% Cooling	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406.2.4: 10% Cooling	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406.3.1: 10% LPA	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406.4: Digital Lt Ctrl	3	3	4	3	4	3	4	4	4	3	3	3	3	4	4	3	3
C406.5: Renewable	8.6	8.5	8.6	8.6	8.6	8.6	8.7	8.5	8.6	7.4	7.5	7.5	7.5	7.4	7.5	7.4	6.3
C406.6: DOAS	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406.7.1: SWH HR	NA																
C406.7.2: SWH NG eff	NA																
C406.7.3: SWH HP	NA																
C406.8: 85% UA	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406.9: Low Leak Env	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

**Table C406.1(5)
Additional Energy Efficiency Credits for Other* Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% Cooling	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10% Cooling	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3.1: 10% LPA	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	8.6	8.6	8.6	8.7	8.6	8.7	8.7	8.5	8.6	7.5	7.5	7.6	7.5	7.5	7.5	7.5	7.4
C406.6: DOAS	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.1: SWH HR**	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.2: SWH FF eff**	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.3: SWH HPWH**	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: 85% UA	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Low Leak Env	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

* Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

** for occupancy groups listed in C406.7.1

C406.5.1 Basic renewable credit. The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2, shall be one of the following:

1. Not less than ~~0.86~~ **0.34** Btu/h per square foot (~~2.7~~ **1.1** W/m²) or ~~0.25~~ **0.10** watts per square foot (~~2.7~~ **1.1** W/m²) of conditioned floor area.
2. Not less than ~~3~~ **1.5** percent of the total building annual energy used ~~within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.~~

Commenter's Reason: In the original CE 218 proposal, the renewable energy credit was based on a percentage of regulated building energy use approach. On review, a few items were found that are improved in this public comment:

- The credits are based on the installed watts per square foot approach, as the savings can be lower. This provides conservative credits without complex adjustments for alternatives.
- The credits vary more with climate zone, as they would in the watts per square foot approach, due to variations in total building energy cost and variations in solar input by climate zone.
- The minimum criteria for this credit was lowered to 0.1 W/square foot installed renewable output, as that allowed for a mix and match with other selections in the credits list. This also makes it easier for high-rise apartments to use the renewable option with photovoltaics.
- The enhanced renewable credits was retained to allow the 0.1 W/square foot to be increased where more renewable credits are desired or to meet the full C406 requirement with just renewable energy.
- To simplify the alternate calculation, the basis is now whole building use, rather than just regulated loads, and the percentage was adjusted to roughly match the watts per square foot approach. Note that there has been a big reduction in regulated loads since this item was introduced more than 12 years ago.

In addition, the terminology and formula symbols were clarified and made more consistent in section C406.5.2, without changing the intent or meaning of C406.5.2.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment reduces the requirement for the renewable credit but also reduces the number of points associated with the credit for has no net effect on the cost of construction.

Public Comment# 2013

Public Comment 4:

IECC@: C406.2.2 (New), C406.2.4 (New)

Proponents:

Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

Further modify as follows:

2018 International Energy Conservation Code

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV. Variable refrigerant flow (VRF) systems with cooling capacities \geq 65,000 Btu/h, shall exceed the minimum EER requirements by 5 percent.

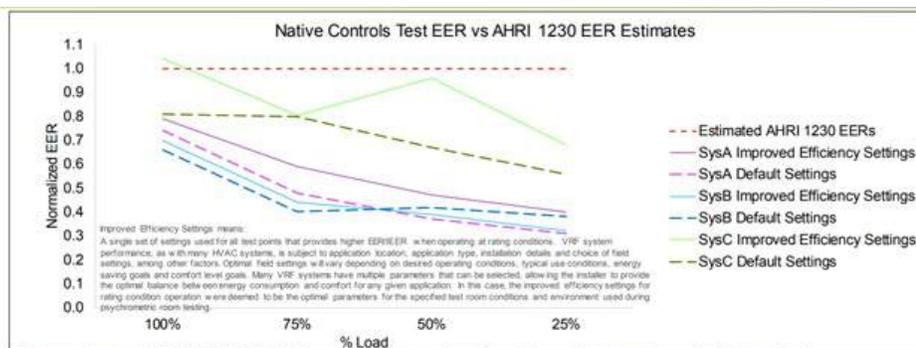
C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV. Variable refrigerant flow (VRF) systems with cooling capacities \geq 65,000 Btu/h, shall exceed the minimum EER requirements by 10 percent.

Commenter's Reason: Thank you for the opportunity to submit comments on Proposal CE218-19. CE-218-19 in its current form is an important, well-conceived improvement to the code, and I urge the committee to adopt it regardless as to whether the small modification proposed here is accepted. CE218-19 is an energy equivalent points based system that provides superior guidance for increasing the energy efficiency of buildings. Without adoption of CE218-19, the IECC would provide equal credit for different measures with significantly different energy impacts.

There is a concern about the use of the IEER metric for variable refrigerant flow (VRF) systems. For most other products, the test procedure to determine the annual energy use metric has been in use for a long time, but the VRF procedure was just created in 2010 and there was no opportunity to observe its use in practice prior to its adoption by DOE. The IEER minimum values adopted by ASHRAE 90.1 and DOE in 2013 were close to the results expected for packaged equipment. However, experience has shown that the test method for VRF requires much improvement and the IEER values in the ASHRAE 90.1 tables are well below most of the VRF products on the market. We recommend the use of EER values for assigning the point credits for higher efficiency VRF systems in CE218-19. Note for small VRF systems ($<$ 65,000 Btu/hr) the only efficiency rating for cooling is SEER. As a result EER is required as the metric of comparison of cooling efficiency only when EER is listed for the particular size and configuration of equipment.

DOE VRF Rulemaking

In 2018 DOE initiated a rulemaking to review the test procedure for VRF, with the intention to move from using EER as the metric to IEER. The DOE chose to form an ASRAC working group, consisting of representatives from industry, energy advocacy organizations and DOE. The ASRAC has not completed its work, but it has determined that the procedure for measuring IEER in the current version of AHRI 1230 requires significant revision. Joint testing conducted by industry, energy advocates, and DOE shows a large discrepancy between the efficiency measured with the control overrides allowed in the current test procedure vs. that found when the controls used in normal operation are applied. These results were presented to the VRF ASRAC Working Group by the VRF ASRAC Testing Joint Subcommittee:



The estimated AHRI 1230 EERs are projected values based on ratings for Standard Rating Test EER at 100% and IEER of each system tested.

Figure 1: EER at each test point using native controls vs. the overridden controls allowed in AHRI 1230. The red line represents the EER for each test point normalized to 1 for each manufacturer. The other lines represent the percentage of that EER when tested with native controls. For example, the point EER for System A with default settings is only 50% of the point EER reported at 75% load.

Another graph from the same presentation showed the change in IEER that would result if native controls testing were applied instead of the current test procedure. The new IEER's would be at best, 73% of the currently reported value and at worst, 40% of that value. The use of the manufacturer's "improved efficiency" settings only yielded a small improvement:

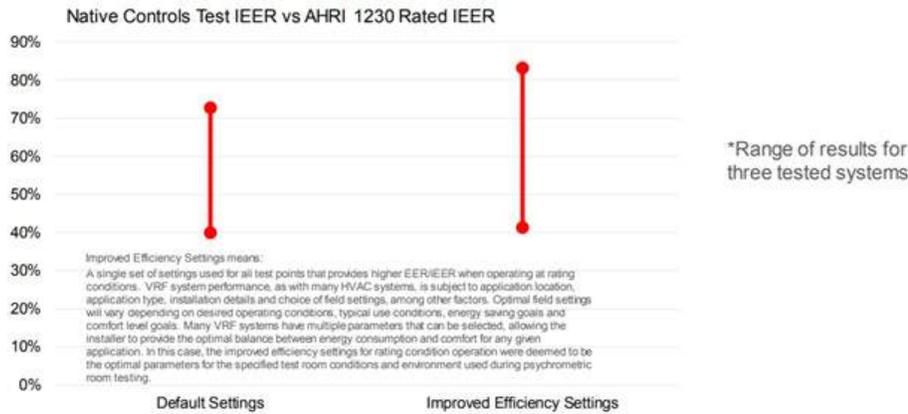


Figure 2: The relative values of IEER calculated from the native controls testing compared to IEER listed in the AHRI database.

The results from the joint committee testing shown here are not meant to imply that the final test procedure proposed by the VRF ASRAC Working Group will change reported VRF IEER's by the same magnitudes. The working group has not yet released a proposed method of test. But it is clear that the test procedure currently used to calculate IEER yields exaggerated results.

Consider using EER for VRF

Based on the DOE work and the results of testing by the California Investor Owned Utilities, the California Energy Commission has chosen to use EER as the basis of evaluating the energy performance of VRFs systems in their 2019 Alternative Compliance Method. Though EER's may also change with the new test procedure, they are not as far off as IEER for VRF.

The AHRI Directory of Certified Performance provides the rated EER and IEER values for all VRF systems sold in North America. These tables compare those values for each model listed in the database to the minimum EER's and IEER's in ASHRAE 90.1. The IEER's are compared to the 90.1 values required after January 1, 2017. The table was not updated for the 2019 version because the VRF ASRAC working group has not completed its work.

All Air-to-Air Heat Pumps in AHRI Database					
EER			IEER		
% better than 90.1 minimum	Count	Proportion	% better than 90.1 minimum	Count	Proportion
>20%	346	13.6%	>100%	136	5.3%
10 to 20%	353	13.9%	50 to 100%	1395	54.8%
5 to 10%	482	18.9%	20 to 50%	923	36.3%
0 to 5%	1223	48.1%	10 to 20%	54	2.1%
Below	140	5.5%	5 to 10%	28	1.1%
	2544		0 to 5%	8	0.3%
				2544	

Figure 3: A comparison of EER and IEER of active air-cooled VRF heat pump models in the AHRI Directory of Certified Performance to the EER and IEER minimum values in ASHRAE 90.1. The minimum values for IEER after January 1, 2017 were used.

If IEER were to be used, more than 98% of the VRF systems exceed the 10% threshold to claim the 10% cooling efficiency credit. If EER were to be used, about 27.5% of systems could claim the 10% cooling efficiency credit, with another 19% able to claim the 5% credit.

Bibliography: The docket containing all information related to the Federal appliance efficiency rulemaking for Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps is found here: <https://www.regulations.gov/docket?D=EERE-2018-BT-STD-0003>
 2019-02-21 - 22 VRF ASRAC Test Sub Committee Working Group Presentation. <https://www.regulations.gov/document?D=EERE-2018-BT-STD-0003-0027>

AHRI Directory of Certified Performance <https://www.ahridirectory.org/Search/SearchHome?ReturnUrl=%2f>

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This change will have no effect on cost because there are a significant number (>25% of models listed in the AHRI database) of VRF systems that exceed the minimum EER requirements by at least 10%.

Public Comment 5:

IECC@: C406.1 (New), C406.1.1, C406.1.2 (New)

Proponents:

Gregory Nicholls, The Preview Group, Inc., representing American Institute of Architects (gnicholls@preview-group.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements New buildings shall comply with either Section C406.1.1 or C406.1.2. shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. ~~More efficient HVAC performance in accordance with Section C406.2.~~
2. ~~Reduced lighting power in accordance with Section C406.3.~~
3. ~~Enhanced lighting controls in accordance with Section C406.4.~~
4. ~~On-site supply of renewable energy in accordance with Section C406.5.~~
5. ~~Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.~~
6. ~~High-efficiency service water heating in accordance with Section C406.7.~~
7. ~~Enhanced envelope performance in accordance with Section C406.8.~~
8. ~~Reduced air infiltration in accordance with Section C406.9~~

C406.1.1 Single credit Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

C406.1.2 Flexible credits New buildings shall achieve a total of 10 credits from Tables C406.1.2(1) through C406.1.2(5). Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit.

Commenter's Reason: The original reason statement said the proposal would not increase or decrease the cost of construction, and that it does not require more investment, but that is rarely the case. Even more rare would be the case for when compliance would cost less.

REASON

For all occupancies, compliance currently is achieved by increasing HVAC efficiency by 10%. For all occupancies in Zone 5A for example, the best case is for Group B, where you get 6 points of the 10 required, which means there will be additional cost to achieve more points. If you choose to add a DOAS system for a project in Zone 5A in this proposal, you get anywhere from 0 to 5 points, where it currently achieves compliance. If your school project in Zone 5A chooses to provide better air leakage, it currently passes, but in this proposal you get 1 point. If you choose renewable energy resources in any zone for any use group, the current code would comply, but under this proposal, none would.

The concept is beautiful, but to sell it as not typically requiring additional cost investment is not true. Rather than scrap the whole thing until scoring (or points needed to pass) is revised, I am suggesting that the designer and owner have the option to use the more flexible matrix being proposed. Feedback then can be used to judge if the matrix is actually as effective as the proponent wishes without increased cost.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. With the option to use the current code choices or the proposed flexible credits, this code change would actually be at no cost increase.

Public Comment# 2032

Public Comment 6:

Proponents:

Hope Medina, representing Colorado Chapter of ICC (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: This proposal is over complicated for end users. The tables listed in this proposal are titled utilizing the building occupancies found in Chapter 3 of the IBC and state occupancies in the titles but Section C406.1 states use groups. There is no reference in this proposal of what is a use group. It could be interpreted as function of space found in Table 1004.5 of the IBC, or building area type found in Table C405.3.2(1) of the IECC, or common space types/building type specific space types found in Table C405.3.2(2) of the IECC, or Section 302.2 of the IBC. The wording should be consistent for all end users to be able to determine what the requirements are asking for. One more demonstration of the complexity of this proposal is when there are multiple uses for the building. The end users are required to perform an area weighted average of floor area to determine the percentage of points to award for that category. In addition there was no equation provided for the end users to be utilized when performing this area weighted average.

This proposal mandates that 10 points are required, but in many of the climate zones and occupancies the projects would be required to do more than 1, or, 2, or 3 practices to obtain 10 points. This proposal also contains values in these tables that exceed the 10 points required. This is confusing to end users why there would values that exceed 10. There should not be values that exceed 10 if the goal number to reach is 10. It appears that this is being set up for future editions of the energy code to increase this number from 10 to a larger number.

This proposal, if approved, may lead to this section of the code no longer being adopted without being amended out. This section has had issues in the past with not being adopted, or enforce for compliance. It does not do any good for energy efficiency when something is written into code that isn't enforced for compliance in the real world application. This section is important for the energy efficiency of projects, and we feel that has been able to get projects more efficient without an exorbitant amount of extra work for any of the end users. It really was a win win for everyone involved in the building community.

The proposal removed the wording of package options to requirements within the title of the section even though this section is about options. We need to be mindful of how this appears to the end users of this code. Currently the title and the section provides options for the building owners and designers to choose additional efficiency for their projects. When you change the title as suggested with this proposal you remove the appearance of having options even though this proposal still is based on options. Why would you want to create more opposition to a section of this code?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1696

Public Comment 7:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Proposals CE218, CE226, and CE240 should be withdrawn by the proponent because they do the opposite of what is intended, and a cost justification was not included. The analysis does attempt to balance out equal energy performance, but it does not take into consideration the cost impact of having to comply with multiple choices of the current code which currently requires only one of the listed efficiency options. For example, choose either 10% HVAC equipment efficiency increase or Reduced Light Power or one of the other 6 options and comply with the code. It is also very difficult to determine code compliance for builders building in multiple zones, because the point system varies drastically across zones and what can be used as a solution in one zone will not receive enough points to qualify in other zones. The following are examples of the combinations of requirements that would be required to comply with the proposed change.

Notes:

1. Changes, in all but Option 4, are based on taking the lowest number or total points available to determine compliance.
2. Numerous options are available beyond the examples shown below. The following is just a sample of the difficulty and if cost were applied to the change the cost impact.

Option 1 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:
2. Provide onsite Renewable Energy in all Zones.
3. Plus, include Reduced Lighting Power of 10% in Zones 3C, 4C and 5C.

Option 2 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:
2. Provide Reduced Lighting Power of 10% in all Zones.
3. Plus, Zone 1B also include a Dedicated Outdoor Air System.
4. Plus, Zones 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5C, 6B, and 7 the builder would be required to include a Heat Pump Water Heater. Zone 3C would also need to include Enhanced Envelope Performance.
5. Zones 1A, 2B, 4C, 5B, and 6A could have an Enhanced Envelope in place of the Heat Pump Water Heater and Zones 4C and 5C would also be required to have Reduced Air Infiltration.
6. Zone 8 would only need to have Reduced Air Infiltration.

Option 3 – 5% Increase Equipment Efficiency.

1. In addition to the 5% HVAC equipment efficiency which the justification states will help in compliance because it is difficult to get a 10% increase in HVAC equipment efficiency the builder would need to:
2. Provide On-Site Renewable Energy.
3. Plus, in Zones 3A, 3B, 4B, 4C, and 5C also Reduce Lighting Power by 10%.
4. Zones 4A, 5A, 5B, 6B, 7 and 8 do not need to have Reduce Light Power of 10%, but they must have Lamp Efficacy.
5. And, Zone 3C can get by with only adding Enhance Envelope to the On-Site Renewable Energy requirement.

Option 4 – If the above is complicated and hard to determine then compliance can be obtained by:

1. Installing 5% Increase HVAC Equipment Efficiency, and
2. Installing a Recovered or Renewable Water Heating System for the entire project.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1214

Public Comment 8:

Proponents:

Martha VanGeem, self, representing Masonry Alliance for Codes and Standards; Emily Lorenz, representing PCI (emilyblorenz@gmail.com)

requests Disapprove

Commenter's Reason: The public comment asks for disapproval because the costs of implementing each item and cost

effectiveness have not been shown. Only energy savings and energy cost savings have been shown in the PNNL report 28370. While the current code has the nine options for reducing energy use, only one was required for compliance. In this proposal, now that it is tabular format, multiple expensive options often need to be chosen.

For example, while C406.3 (reduced lighting power) was reported as the most chosen option in the current code, now other options need to also be chosen for various building types and climate zones. For example, see Group R and I occupancies in Table C406.1(2). Or Group B occupancies for Climate Zones 4 through 8 in Table C406.1(1). Both of these require more than one option.

In other instances, the designer can now achieve 10 points for C406.3, which is 10% lower lighting power density. However, the lighting requirements are now so efficient (if CE206 on lower lighting power densities is approved, which was unanimously approved by the committee) that complying with C406.3 will be VERY difficult, especially considering the manner in which LED lights illuminate a space.

As another example, if the designer does not choose C406.3 (lower lighting power density) because CE206 is approved, then the designer is left doing almost everything else in order to obtain 10 points in schools Table C406.1(3), Climate Zone 5A (Chicago and many other highly populated cities east of the Mississippi River). This assumes that renewables will also not be chosen because they are often more expensive. Option C406.6 DOAS is not available for schools.

That leaves only 5 options:

- 3 points from C406.2.3 (heating),
- 2 points for C406.4 (digital controls),
- 2 points max for C406.7 (service water heating),
- 2 points for C406.8 (UA), and
- 1 point for C406.9 (air leakage).

All 5 of these would need to be met. The lower UA values have not been shown to be cost effective. The PNNL report shows very little energy savings (and sometimes increased energy use) for lower UA. An air leakage value of 0.25 has not been shown to be cost effective. The PNNL report shows very little energy savings (and sometimes increased energy use) for lower air leakage, and this is presuming air leakage reduction from 1.0 down to 0.25 cfm/ft². This baseline of 1.0 cfm/ft² for the 2018 code seems questionable when the current code requires an air leakage of 0.40 and when considering the more recent testing results in the cited research in ASHRAE 1478-RP by Wagdy Anis, Wiss Janey, and Elstner.

- **In the current code only ONE option was required. Cost effectiveness for meeting these multiple options or expensive options has not been shown.**

Because of the above, the cost impact statement is incorrect. The proposal will most likely increase the cost of construction. It will more likely require more investment because it will often require a more expensive item from the list or more than one item from the list. A detailed cost effectiveness analysis for different types of buildings in different climates is required.

This would make a great guide for above code programs that don't take into account cost effectiveness, but doesn't belong in the IECC.

The correct reference for ASHRAE 1478 RP is:

Anis, Wagdy. 2014. ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings. Wiss, Janney, Elstner Associates, Inc. for ASHRAE. www.ashrae.org

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The net effect of a Disapprove action is that the code will not be changed, therefore there are no potential cost impacts.

CE219-19

IECC@: C406.1

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with ~~one~~ two or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Reason: Section C406.1 establishes a set of additional efficiency measure options above base code requirements. The present code requires compliance with only one measure, yet the list of efficiency options has continued to grow without adding any efficiency to buildings. This proposal would modify the requirement so buildings would comply with two packages instead of just one to increase the energy efficiency of buildings.

Cost Impact: The code change proposal will increase the cost of construction
The impact would be the cost of the added measure which increases the energy efficiency of the building.

CE219-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on action on CE218 (Vote: 13-2).

Assembly Action:

None

CE219-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Submitted

Commenter's Reason: Because of successful approval of CE218 as modified at the Committee Action Hearing, this proposal was not necessary and therefore not approved. This As Submitted proposal is needed to progress the energy efficiency of the code in the event CE218 is not approved at the Public Comment Hearing. This public comment would allow this proposal, CE219, to be heard and would not be called to the floor if CE218 is successful in the PCH.

Reason statements and justifications from the original proposal still stand as originally submitted.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This proposal will increase the energy efficiency of the energy code through adding a second efficiency option to buildings. Return on investment for each additional efficiency package option is as noted in each individual option's proposal reason statement.

Public Comment# 1441

Public Comment 2:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Submitted

Commenter's Reason: Increasing the requirement from one to two increases energy efficiency while remaining flexible and providing options to do it. Allowing the designer and owner to determine what is the best option for their project.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The proposal's cost impact statement is accurate.

Public Comment# 1539

CE220-19

IECC@: C406.1

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with ~~one~~ two or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Reason: The purpose of this code change proposal is to improve the efficiency of the prescriptive compliance path by requiring the selection of two additional efficiency package options instead of only one. Section C406 was adopted in the 2012 IECC not only as an immediate efficiency improvement, but also as a means of facilitating code improvements in the future. As new technologies become available, the package options can be updated or the list of options can be expanded (as it was in the 2018 IECC) to provide more flexibility for code users. As additional efficiency is needed, the number of required options can be increased.

Several states have adopted a package- or points-based approach similar to Section C406, and as more efficiency is needed, the number of options (or points) has been increased. We note that this proposal deals only with the prescriptive path, and that a separate proposal will address needed efficiency improvements in the performance path.

Cost Impact: The code change proposal will increase the cost of construction

The proposal requires additional efficiency measures to be installed in the building which will increase costs. However, we expect that design professionals and builders will select the package options that are the most cost-effective and the easiest to implement into specific designs.

CE220-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: Based on action on CE218 and CE219 (Vote: 13-2).

Assembly Action:

None

CE220-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it is a simple improvement in energy efficiency that would be easily implemented by any jurisdiction that has adopted the 2012, 2015, or 2018 IECC. It maintains the current structure of Section C406, and simply increases the required number of options from one to two.

We acknowledge that the Committee favored a more comprehensive revision of this section through CE218 and related proposals. CE218 and CE220 are mutually exclusive. However, it is not certain whether CE218 will be finally approved. If not, CE220 is technically sound, and if the structure of Section C406 that has been adopted in most states is retained, this moderate improvement in efficiency will be valuable.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. As stated in the original proposal, the proposal requires additional efficiency measures to be installed in the building which will increase costs. However, we expect that design professionals and builders will select the package options that are the most cost-effective and the easiest to implement into specific designs.

Public Comment# 1450

CE224-19

IECC: C406.2, TABLE C406.2 (New)

Proposed Change as Submitted

Proponents: Mark Lessans, Ingersoll Rand, representing Ingersoll Rand (mark.lessans@irco.com)

2018 International Energy Conservation Code

Revise as follows:

C406.2 More efficient HVAC equipment performance. Equipment shall ~~exceed~~ comply with the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, following requirements, as applicable, in addition to the requirements of Section C403. ~~Where multiple performance requirements are provided, the equipment shall exceed all requirements by:~~

1. Package unitary air-cooled systems with cooling capacity greater than 65,000 Btu/h shall meet or exceed the applicable efficiency requirements listed in Table C406.2, or shall exceed the mandatory federal minimum efficiency requirements for IEER by not less than 10 percent, whichever is greater.
2. All other electrically operated unitary air conditioners and heat pumps with cooling capacity less than 760,000 Btu/h shall exceed the mandatory federal minimum efficiency requirements by not less than 10 percent.
3. Variable refrigerant flow systems shall exceed the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by not less than 10 percent.
4. All other systems shall exceed the applicable minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by not less than 10 percent. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) shall be limited to 10 percent of the total building system capacity.

Add new text as follows:

TABLE C406.2

MINIMUM EFFICIENCY REQUIREMENTS: MORE EFFICIENT HVAC EQUIPMENT PERFORMANCE UNITARY AIR-COOLED SYSTEMS

<u>EQUIPMENT TYPE</u>	<u>SIZE CATEGORY</u>	<u>HEATING SECTION TYPE</u>	<u>SUBCATEGORY OR RATING CONDITION</u>	<u>MINIMUM EFFICIENCY</u>	<u>TEST PROCEDURE</u>
<u>Air conditioners, air cooled</u>	<u>≥ 65,000 Btu/h and < 135,000 Btu/h</u>	<u>Electric Resistance (or None)</u>	<u>Single Package</u>	<u>18.0 IEER</u>	<u>AHRI 340/360</u>
		<u>All other</u>	<u>Single Package</u>	<u>17.8 IEER</u>	
	<u>≥ 135,000 Btu/h and < 240,000 Btu/h</u>	<u>Electric Resistance (or None)</u>	<u>Single Package</u>	<u>17.0 IEER</u>	
		<u>All other</u>	<u>Single Package</u>	<u>16.8 IEER</u>	
	<u>≥ 240,000 Btu/h</u>	<u>Electric Resistance (or None)</u>	<u>Single Package</u>	<u>14.5 IEER</u>	
		<u>All other</u>	<u>Single Package</u>	<u>14.3 IEER</u>	
<u>Heat pumps, air cooled (cooling mode)</u>	<u>≥ 65,000 Btu/h and < 135,000 Btu/h</u>	<u>Electric Resistance (or None)</u>	<u>Single Package</u>	<u>16.0 IEER</u>	<u>AHRI 340/360</u>
		<u>All other</u>	<u>Single Package</u>	<u>15.8 IEER</u>	
	<u>≥ 135,000 Btu/h and < 240,000 Btu/h</u>	<u>Electric Resistance (or None)</u>	<u>Single Package</u>	<u>15.0 IEER</u>	
		<u>All other</u>	<u>Single Package</u>	<u>14.8 IEER</u>	
	<u>≥ 240,000 Btu/h</u>	<u>Electric Resistance (or None)</u>	<u>Single Package</u>	<u>14.5 IEER</u>	
		<u>All other</u>	<u>Single Package</u>	<u>14.3 IEER</u>	
<u>Heat pumps, air cooled (heating mode)</u>	<u>≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)</u>	=	<u>47° F db/43° F wb outdoor air</u>	<u>3.5 COP</u>	<u>AHRI 340/360</u>
	<u>≥ 135,000 Btu/h (cooling capacity)</u>	=	<u>47° F db/43° F wb outdoor air</u>	<u>3.6 COP</u>	

Reason: The purpose of this code change proposal is to ensure that next-generation commercial unitary air conditioners and heat pumps - those which are high-efficiency by future standards - are effectively promoted by Section C406.2 of the IECC. In doing so, this proposal will better align the energy code with DOE appliance and equipment standards, above-code programs, and manufacturer plans to improve their product offerings in response to them.

As written, C406.2 requires that all minimum efficiency requirements listed in the equipment efficiency tables of Section C403 be exceeded 10 percent. This requirement is appropriate new buildings which utilize multiple equipment types for space conditioning, as well as for equipment that has multiple performance compliance paths. However, for package air-cooled unitary systems, conventionally referred to as rooftop units (RTUs), there are typically three different efficiency metrics listed in the equipment efficiency tables, all of which must be met. Exceeding these efficiencies proportionally does not make sense given updated standards and the capabilities of RTUs, and creates conflicting as well as commercially unattainable requirements.

This proposal solves this issue for package RTUs by focusing their requirements in C406.2 predominantly on cooling efficiency as defined by IEER, as this equipment operates primarily in cooling mode, even in cold climates. Additionally, IEER is the metric used by DOE for federal appliance standards covering this equipment. This proposal aligns efficiency requirements for commercial unitary air conditioners with those in the Consortium for Energy Efficiency (CEE) Advanced Tier specification, which took effect on January 1, 2019. CEE does not develop an Advanced Tier specification for commercial package heat pumps, so improvements proportionally similar are used in this proposal.

If approved, this proposal would raise IEER for package air-cooled unitary systems by roughly 25-40% above the requirements of Section C403, as well as roughly 10-20% above the efficiencies required by updated DOE appliance standards that take effect in 2023. Additionally, this proposal creates a “backstop” of 10% above federal appliance standards, so that the intent of Section C406.2 is met if DOE standards for this equipment is updated prior to revisions to Table C406.2. All other efficiency metrics governing RTUs will remain in place, as the equipment still must comply with all requirements of Section C403.

This code change is necessary to avoid conflicting requirements between EER and IEER, as well as commercially unattainable requirements for AFUE. Regarding EER (full-load performance) and IEER (blended part- and full-load performance), optimizing for one performance condition will

yield sub-optimal performance at another. While new products may improve both EER and IEER, one can only be improved incrementally at the expense of the other, and therefore requiring both to improve proportionally is not appropriate. Regarding AFUE, the requirements placed on furnaces and gas heating elements by C406.2 requires moving to a condensing technology, which is not commercially available in RTUs outside of highly niche applications. The product availability gap is related to condensate disposal; in rooftop applications there is no industry-accepted practice to dispose of condensing furnace condensate discharge, and inappropriate applications will lead to roof damage.

This code change proposal makes significant improvements to package air-cooled unitary system cooling efficiencies, and removes conflicting requirements that would prevent premium efficiency, next-generation equipment from being used in new construction. It maintains the intent of Section C406, while also keeping C406.2 relevant given changes to appliance standards and industry innovation since its original inclusion in the 2012 IECC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change only.

CE224-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: As written, it does not connect to prior approved sections in CE218 (Vote: 15-0).

Assembly Action: **None**

CE224-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.2, 406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.2.5 (New)

Proponents:

Mark Lessans, representing Ingersoll Rand (mark.lessans@irco.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. ~~C403.3.2(9)~~ and *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. Equipment IES 90.1 in accordance with Sections C406.2.1, C406.2.2, C406.3.3, or C406.2.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2, C406.2.4 or C406.2.5. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ ~~C403.3.2(9)~~ and *Variable refrigerant flow systems* not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system capacity. capacity for heating equipment where selecting C406.2.1 or C406.2.3 and cooling equipment where selecting C406.2.2, C406.2.4 or C406.2.5.

406.2.1 Five percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

406.2.2 Five percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

406.2.3 Ten percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements

by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.5 More than ten percent cooling efficiency improvement. Where equipment exceeds the minimum annual cooling and heat rejection efficiency requirements by more than 10 percent, energy efficiency credits for cooling may be determined using Equation 4-1, rounded to the nearest whole number. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

$$EEC_{HEC} = EEC_{10} \times [1 + ((CEI - 10 \text{ percent}) \div 10 \text{ percent})] \text{ (Equation 4-1)}$$

Where:

EEC_{HEC} = energy efficiency credits for cooling efficiency improvement

EEC₁₀ = C406.2.4 credits from Tables C406.1(1) through C406.1(5)

CEI = the lesser of: the improvement above minimum cooling and heat rejection efficiency requirements, or 15 percent

Commenter's Reason: This proposal has been modified in light of committee action on CE 218. As revised, C406.2 allows the building designer to take credits for high efficiency HVAC cooling performance, but only for improvements in cooling efficiency of up to 10% above the energy efficiency requirements in C403. This presents a significant gap, as there are high efficiency HVAC systems commercially available today that go well beyond a 10% improvement in cooling performance over the minimum requirements.

This public comment simply adds an additional subsection to CE 218, C406.2.5, to address this gap. With this additional language, if a building designer selects an HVAC system with a cooling performance that exceeds minimum requirements by more than 10%, they would be able to get additional energy efficiency credits proportional to the improvement of the cooling performance. For example, if equipment is selected that exceeds minimum cooling efficiency requirements by 12%, she would be able to multiply credits taken in C06.2.4 by 1.2.

Approval of this proposal as modified by public comment will help enable next-generation, high efficiency HVAC systems to receive appropriate credit under the revised C406 format. This will give designers additional flexibility under C406, while achieving the same level of energy savings, and help pull through premium efficiency equipment into the marketplace.

Credit for performance is capped at 15% above minimum cooling performance requirements, or a "points multiplier" of 1.5, in order to discourage a designer from selecting an inappropriate system for a given application, merely because of its energy efficiency rating. This cap has been revised downward from 20% in response to concerns raised at the Committee Action Hearings that a 20% maximum allowable cooling performance improvement was too high.

Examples:

(1) Group B Building in Climate Zone 5B with Cooling Efficiency Improvement of 12% = 6 energy efficiency credits:

$$EEC_{HEC} = 5 \text{ credits} \times [1 + ((12\% - 10\%) \div 10\%)] = 5 \text{ credits} \times 1.2 = 6 \text{ credits}$$

(2) Group R Building in Climate Zone 2A with Cooling Efficiency Improvement of 13% = 5 energy efficiency credits:

$$EEC_{HEC} = 4 \text{ credits} \times [1 + ((13\% - 10\%) \div 10\%)] = 4 \text{ credits} \times 1.3 = 5.2 \text{ credits (round to 5 credits)}$$

(3) Group E Building in Climate Zone 3B with Cooling Efficiency Improvement of 25% = 6 energy efficiency credits:

$$EEC_{HEC} = 4 \text{ credits} \times [1 + ((15\% - 10\%) \div 10\%)] = 4 \text{ credits} \times 1.5 = 6 \text{ credits (capped at performance improvement of 15\%)}$$

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

Under Section C406 as revised, building designers will need as many options as possible to achieve credits toward compliance. This proposal creates the opportunity for additional points through cooling efficiency, thereby increasing flexibility without sacrificing efficiency, and allowing designers to choose a more optimal path forward. As such, it will decrease the cost of construction. Finally, this added flexibility will make it easier for a jurisdiction to go beyond code and require more than 10 additional energy efficiency credits under C406.

Public Comment# 1149

CE226-19

IECC@: SECTION C406, C406.1, TABLE C406.1(1) (New), TABLE C406.1(2) (New), TABLE C406.1(3) (New), TABLE C406.1(4) (New), TABLE C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.3, C406.3.1, C406.3.3 (New), C406.5 (New), C406.5.1, C406.5.2 (New), C406.7, C406.7.1, C406.7.2, C406.7.3 (New), C406.7.4 (New)

Proposed Change as Submitted

Proponents: Louis Starr, representing Northwest Energy Efficiency Alliance (lstarr@neea.org)

2018 International Energy Conservation Code

SECTION C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS REQUIREMENTS

C406.1 Requirements- Additional efficiency requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits may also be as calculated in accordance the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Add new text as follows:

TABLE C406.1(1)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCIES

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406.2.1: 5% Heating Eff Imprv.	NA	1	NA	NA	1	1	NA	1									
C406.2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10 % Heating Eff Imprv.	NA	1	NA	NA	2	1	1	2	2	NA	1						
C406.2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3.1: Reduce Light Power 10%	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.3.3: Lamp Efficacy	NA	NA	NA	NA													
C406.4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406.7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406.7.4: Heat Pump SWH	NA	NA	NA	NA													
C406.8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

TABLE C406.1(2)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3.1: Reduce Light Power 10%	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .3.3: Lamp Efficacy	2	2	2	2	1	2	2	1	1	1	1	1	1	1	1	1	1
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

**TABLE C406.1(3)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP E OCCUPANCIES**

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406 .2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406 .3.1: Reduce Light Power 10%	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406 .3.3: Lamp Efficacy	NA	NA	NA	NA													
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406 .6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA													
C406 .7.2: Recovered/Renew SWH ^a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH ^a	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH ^a	NA	1	NA	NA	1	1	NA	1	1	1	1						
C406 .8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406 .9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

a. For schools with full service kitchens or showers

TABLE C406.1(4)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP M OCCUPANCIES

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3.1: Reduce Light Power 10%	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .3.3: Lamp Efficacy	NA	NA	NA	NA													
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA													
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

**TABLE C406.1(5)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR OTHER OCCUPANCIES**

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406 .2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406 .2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406 .3.1: Reduce Light Power 10%	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406 .3.3: Lamp Efficacy	NA	NA	NA														
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406 .7.2: Recovered/Renew SWH ^b	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH ^b	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH ^b	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406 .9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

b. For occupancy groups listed in C406 .7.1.

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options from Tables C406 .1(1) through C406 .1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. ~~Alternatively Where the entire building complies using credits from Section C406 .5, C406 .8 or C406 .9, tenant spaces within the building shall be deemed to comply with Section C406.5 where the entire building is in compliance; this section~~

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. ~~Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. C403.3.2(9) and Variable refrigerant flow systems shall exceed listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. Equipment in accordance with Sections C406 .2.1, C406 .2.2, C406 .2.3 or C406 .2.4.~~ Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406 .2.1 or C406 .2.3 and energy efficiency credits for cooling shall be selected from C406 .2.2 or C406 .2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) ~~C403.3.2(9)~~ shall be limited to 10 percent of the total building system capacity. capacity for heating equipment where selecting C406 .2.1 or C406 .2.3 and cooling equipment where selecting C406 .2.2 or C406 .2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.3 Reduced lighting power. The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90 percent of the total lighting power allowance calculated in accordance with Section C405.3.2.

Buildings shall comply with Section C406.3.1 or C406.3.2 and dwelling units and sleeping units within the building shall comply with C406.3.3.

~~C406.3~~ **C406.3.1 Reduced lighting power- power by more than 10 percent.** The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90 percent of the total lighting power allowance calculated in accordance with Section C405.3.2.

Add new text as follows:

C406.2.3 Reduced lighting power by more than 15 percent. Where the total connected interior lighting power calculated in accordance with Section C405.3.1 is less than 85 percent of the total lighting power allowance calculated in accordance with Section C405.3.2, additional energy efficiency credits shall be determined based on Equation 4-12, rounded to the nearest whole number.

$$AEEC_{LPA} = AEEC_{10} \times 10 \times (LPA - LPD) / LPA \text{ (Equation 4-12)}$$

Where:

$$AEEC_{LPA} = \text{C406.3.2 additional energy efficiency credits}$$

LPD = total connected interior lighting power calculated in accordance with Section C405.3.1

LPA = total lighting power allowance calculated in accordance with Section C405.3.2

$$AEEC_{10} = \text{C406.3.1 credits from Tables C406.1(1) through C406.1(5)}$$

C406.3.3 Lamp efficacy Not less than 95 percent of the interior lighting power (watts) from lamps in permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 65 lumens per watt.

C406.5 On-site renewable energy. Buildings shall comply with Section C406.5.1 or C406.5.2

Revise as follows:

~~C406.5~~ **C406.5.1 On-site renewable energy. Basic Renewable Credits** The total minimum ratings of on-site renewable energy systems not including systems used for credits under Section C406.7.2 shall be one of the following:

1. Not less than ~~1.71~~0.86 Btu/h per square foot (~~5.4~~2.7 W/m²) or ~~0.50~~0.25 watts per square foot (~~5.4~~2.7 W/m²) of conditioned floor area.
2. Not less than ~~3~~2 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Add new text as follows:

C406.5.2 Enhanced Renewable Credit Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406.5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$$AEEC_{RRa} = AEEC_{2.5} \times RR_a / RR_1 \text{ (Equation 4-13)}$$

Where:

$$AEEC_{RRa} = \text{C406.5.2 additional energy efficiency credits}$$

RR_a = actual total minimum ratings of *on-site renewable energy* systems (in Btu/h, watts per square foot or W/m²)

RR_1 = minimum ratings of *on-site renewable energy* systems required by C406.5.1(1) (in Btu/h, watts per square foot or W/m²)

$$AEEC_{2.5} = \text{C406.5.1 credits from Tables C406.1(1) through C406.1(5)}$$

C406.7 Reduced energy use in service water heating. Buildings shall comply with Sections C406.7.1 and either C406.7.2, C406.7.3 or C406.7.4.

Revise as follows:

~~C406.7~~ **C406.7.1 Reduced energy use in service water heating- Building Type** Buildings shall be To qualify for this credit, the building shall contain one be of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following ~~types to use this compliance method~~ groups:

1. *Group R-1*: Boarding houses, hotels or motels.
2. *Group I-2*: Hospitals, psychiatric hospitals and nursing homes.
3. *Group A-2*: Restaurants and banquet halls or buildings containing food preparation areas.
4. *Group F*: Laundries.
5. *Group R-2*.

6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~C406.7.1 C406.7.2 Load fraction. Recovered or renewable water heating~~ The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60-30~~ percent of the building's annual hot water requirements, or sized to provide ~~40-70~~ percent of the building's annual hot water requirements if the building ~~shall otherwise be required to comply with Section C403.9.5:~~

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

Reason: C406 Credits for Dwelling Lighting Efficacy

This proposal builds on top of a proposal that assigns energy efficiency credits to each option in Section C406 (CE218-19). For clarity, that entire base proposal is included here with additional provisions and table row additions that provide additional energy efficiency credits when:

- The lighting power density is reduced by more than 15% below the required lighting power allowance. For this option the 10% reduction credits in Section C406.3.1 are multiplied by the ratio of actual lighting power density reduction to lighting power allowance
- The efficacy of lamps installed in sleeping and dwelling units is higher than required in the residential section of the code and appropriate credits for that improvement are added as new lines in the credit tables.

The provision expands the available credits for more than 10% lighting power reduction where the lighting power density is reduced by more than 15%.

Currently, a 10% lighting reduction in lighting power allowance is required for this extra efficiency option; however dwelling units and sleeping units can follow the residential lighting efficacy requirements. As a result, the applicability of option C406.3 is unclear for multi-family buildings. This measure would make clear the 10% lighting reduction applies to areas in a multi-family building that are not dwelling units and sleeping units and would apply a higher efficacy rating in the dwelling and sleeping units than is required in the residential lighting requirements.

To achieve this extra efficiency credit, this measure would increase the efficacy requirement for lamps in permanently installed fixtures and make them more in line with lamps available today.

This measure provides more clarity for multi-family buildings for the extra efficiency credit. Lamps meeting the higher efficacy requirement are readily available and appropriate for an optional credit.

Bibliography:

Hart, R., R. Nambiar, M. Tyler, M., Y. Xie, and J. Zhang. "Relative Credits for Extra Efficiency Measures: Technical Brief." Pacific Northwest National Laboratory (PNNL), Richland, WA (US), January 2019.

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370Rev.1.pdf.

www.1000bulbs.com for lamp prices

Cost Impact: The code change proposal will not increase or decrease the cost of construction

To achieve the lighting credit in multi-family buildings, this proposal will require higher efficacy lamps in dwelling units and sleeping units. However, these lamps are readily available in the market place, and checking internet sources has found them to actually be less costly than the slightly lower efficacy alternative required under the residential code. LED lamps were found to be about 85% the cost of similar output compact fluorescent lamps. If compared to incandescent lamps, there may be a cost increase, but the life of either the CFL or LED lamps is 10 or 15 times as long, resulting in a much lower cost per year of service.

Further, the current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC. In fact, credit is now given to lighting reductions greater than 10%. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices.

There is not expected to be an increased cost, as several of the evaluated options are included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

CE226-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

C406.1 Additional efficiency requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits may also be as calculated in accordance the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

C406.3.3 Lamp efficacy. Not less than 95 percent of the permanently installed lighting, excluding kitchen appliance light fixtures, serving interior lighting power (watts) from lamps in permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum an efficacy of not less than 65 lumens per watt or luminaires with an efficacy of not less than 45 lumens per watt.

Committee Reason: The proposal increases lighting reduction The modifications brought consistency with CE262, CE218 and allowed exemption for kitchen appliance lighting (Vote: 13-2).

Assembly Action:

None

CE226-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Proposals CE218, CE226, and CE240 should be withdrawn by the proponent because they do the opposite of what is intended, and a cost justification was not included. The analysis does attempt to balance out equal energy performance, but it does not take into consideration the cost impact of having to comply with multiple choices of the current code which currently requires only one of the listed efficiency options. For example, choose either 10% HVAC equipment efficiency increase or Reduced Light Power or one of the other 6 options and comply with the code. It is also very difficult to determine code compliance for builders building in multiple zones, because the point system varies drastically

across zones and what can be used as a solution in one zone will not receive enough points to qualify in other zones. The following are examples of the combinations of requirements that would be required to comply with the proposed change.

Notes:

1. Changes, in all but Option 4, are based on taking the lowest number or total points available to determine compliance.
2. Numerous options are available beyond the examples shown below. The following is just a sample of the difficulty and if cost were applied to the change the cost impact.

Option 1 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:
2. Provide onsite Renewable Energy in all Zones.
3. Plus, include Reduced Lighting Power of 10% in Zones 3C, 4C and 5C.

Option 2 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:
2. Provide Reduced Lighting Power of 10% in all Zones.
3. Plus, Zone 1B also include a Dedicated Outdoor Air System.
4. Plus, Zones 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5C, 6B, and 7 the builder would be required to include a Heat Pump Water Heater. Zone 3C would also need to include Enhanced Envelope Performance.
5. Zones 1A, 2B, 4C, 5B, and 6A could have an Enhanced Envelope in place of the Heat Pump Water Heater and Zones 4C and 5C would also be required to have Reduced Air Infiltration.
6. Zone 8 would only need to have Reduced Air Infiltration.

Option 3 – 5% Increase Equipment Efficiency.

1. In addition to the 5% HVAC equipment efficiency which the justification states will help in compliance because it is difficult to get a 10% increase in HVAC equipment efficiency the builder would need to:
2. Provide On-Site Renewable Energy.
3. Plus, in Zones 3A, 3B, 4B, 4C, and 5C also Reduce Lighting Power by 10%.
4. Zones 4A, 5A, 5B, 6B, 7 and 8 do not need to have Reduce Light Power of 10%, but they must have Lamp Efficacy.
5. And, Zone 3C can get by with only adding Enhance Envelope to the On-Site Renewable Energy requirement.

Option 4 – If the above is complicated and hard to determine then compliance can be obtained by:

1. Installing 5% Increase HVAC Equipment Efficiency, and
2. Installing a Recovered or Renewable Water Heating System for the entire project.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

CE229-19

IECC: C202, C406.1, TABLE C406.1(1) (New), TABLE C406.1(2) (New), TABLE C406.1(3) (New), TABLE C406.1(4) (New), TABLE C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.3 (New), C406.2.4 (New), C406.4, C406.5, C406.5.1 (New), C406.5.2 (New), C406.7, C406.7.1 (New), C406.7.1, C406.7.3 (New), C406.7.4 (New)

Proposed Change as Submitted

Proponents: Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

LUMEN MAINTENANCE CONTROLS: A lighting control strategy that adjusts luminaire power over time to maintain constant light output as luminaires age, dirt accumulates or both. This strategy allows for energy savings in the life of the system then increases power as the system ages.

HIGH END TRIM: A lighting control strategy that sets the required maximum light level for each space.

SECTION C406 **ADDITIONAL EFFICIENCY PACKAGE OPTIONS REQUIREMENTS**

C406.1 Requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Alternatively, credits shall be as calculated in accordance the relevant subsection of Section C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Add new text as follows:

TABLE C406.1(1)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCY

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406.2.1: 5% Heating Eff Imprv.	NA	1	NA	NA	1	1	NA	1									
C406.2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10 % Heating Eff Imprv.	NA	1	NA	NA	2	1	1	2	2	NA	1						
C406.2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enh. Digital Light Ctrl	4	4	4	4	4	4	4	3	4	4	3	3	4	3	3	3	3
C406.5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406.7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406.7.4: Heat Pump SWH	NA	NA	NA	NA													
C406.8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

TABLE C406.1(2)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3: Reduced Light Power	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

TABLE C406.1(3)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP E OCCUPANCY

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3: Reduced Light Power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Enh. Digital Light Ctrl	3	4	3	4	3	4	3	4	5	4	4	5	3	4	4	3	2
C406.5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406.6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA													
C406.7.2: Recovered/Renew SWH ^a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.7.3: Eff fossil fuel SWH ^a	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406.7.4: Heat Pump SWH ^a	NA	1	NA	NA	1	1	NA	1	1	1	1						
C406.8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

a. For schools with showers or full service kitchens

TABLE C406.1(4)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP M OCCUPANCIES

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3: Reduced Light Power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA													
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

C406.1(5)

TABLE Additional Energy Efficiency Credits for Other^a Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3: Reduced Light Power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Enh. Digital Light Ctrl	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	3	3
C406.5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406.6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.2: Recovered/Renew SWH ^b	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Eff fossil fuel SWH ^b	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat Pump SWH ^b	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

b. For occupancy groups listed in Section C406.7.1.

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options from Tables C406 .1(1) through C406 .1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. ~~Alternatively, tenant spaces shall~~ Where the entire building complies using credits from Section C406.5, C406.8 or C406.9 tenant spaces within the buildings shall be deemed to comply with Section C406.5 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ by 10 percent, in addition to the requirements of Section C403. ~~Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent.~~ C403.3.2(9) and Variable refrigerant flow systems shall exceed listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. ~~Equipment in accordance with Section C406.2.1, C406.2.2, C406.2.3 or C406.2.4.~~ Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from Section C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from Section C406.2.2 or C406.2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. . Equipment not listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ C403.3.2(9) and Variable refrigerant flow systems not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system capacity-capacity for heating equipment where selecting Section C406.2.1 or C406.2.3 and cooling equipment where selecting Section C406.2.2 or C406.2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.4 Enhanced digital lighting controls. ~~Interior lighting in~~ At least 90 percent of the building floor area shall have interior lighting with the following enhanced lighting controls for luminaires providing general lighting, that shall be located, scheduled and operated in accordance with Section ~~C405.2.2; C405.2.~~

1. Luminaires shall be configured for continuous dimming.

2. Luminaires shall be addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaires shall be allowed.
3. Not more than eight luminaires shall be controlled together in a *daylight zone*.
4. Fixtures shall be controlled through a digital control system that includes the following function:
 - 4.1. Control reconfiguration based on digital addressability.
 - 4.2. Load shedding.
 - 4.3. Individual user control of overhead general illumination in open offices.
 - 4.4. Occupancy sensors shall be capable of being reconfigured through the digital control system.
5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4.
6. Functional testing of lighting controls shall comply with Section C408. High end trim controls shall be enabled and configured to limit the initial maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw for both of the following:
 - 6.1 All areas that have *lumen maintenance controls*
 - 6.2 50% of the remaining floor area.

C406.5 On-site renewable energy. ~~The total minimum ratings of on-site renewable energy systems shall be one of the following:~~

1. ~~Not less than 1.71 Btu/h per square foot (5.4 W/m²) or 0.50 watts per square foot (5.4 W/m²) of conditioned floor area.~~
2. ~~Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.~~

Buildings shall comply with Section C406 .5.1 or C406 .5.2.

Add new text as follows:

C406.5.1 Basic renewable credits. The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2 shall be one of the following:

1. Not less than 0.86 Btu/h per square foot (2.7 W/m²) or 0.25 watts per square foot (2.7 W/m²) of conditioned floor area.
2. Not less than 2 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

C406.5.2 Enhanced Renewable Credits Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406.5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$$AEEC_{RRa} = AEEC_{2.5} \times RR_a / RR_1 \text{ (Equation 4-13)}$$

Where:

$AEEC_{RRa}$ = C406 .5.2 additional energy efficiency credits

RR_a = actual total minimum ratings of *on-site renewable energy* systems in Btu/h, watts per square foot or W/m²)

RR_1 = minimum ratings of *on-site renewable energy* systems required by C406 .5.1(1) in Btu/h, watts per square foot or W/m²)

$AEEC_{2.5}$ = C406 .5.1 credits from Tables C406.1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Section C406 .7.1 and Section C406.7.2, C406.7.3 or C406 .7.4.

Revise as follows:

~~**C406.7- C406.7.1 Reduced energy use in service water heating-Building type.** To qualify for this credit, the building shall contain one be of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following types to use this compliance method groups:~~

1. *Group R-1:* Boarding houses, hotels or motels.
2. *Group I-2:* Hospitals, psychiatric hospitals and nursing homes.
3. *Group A-2:* Restaurants and banquet halls or buildings containing food preparation areas.
4. *Group F:* Laundries.

5. Group R-2.

6. Group A-3: Health clubs and spas.

7. Group E: Schools with full-service kitchens or locker rooms with showers

8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~C406.7.1 C406.7.2 Load fraction.~~ **Recovered or renewable water heating.** The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60-30~~ percent of the building's annual hot water requirements, or sized to provide ~~40-70~~ percent of the building's annual hot water requirements if the building ~~shall otherwise be required to comply with Section C403.9.5:~~

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95 percent Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater. Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

Reason:

C406 Credits for Enhanced digital lighting controls.

This proposal builds on top of a proposal (CE218-19) that assigns energy efficiency credits to each option in Section C406. For clarity, that entire base proposal is included here. Additional provisions and table row modifications are as follows:

- The provisions of Enhanced Digital lighting are clarified to require high end trim tuning, including definitions to support those clarifications.
- The credits in the tables are increased for enhanced digital light control based on the clarified provisions in C406.4 that are expected to produce increased savings.

Compared to the existing enhanced lighting controls in C406.4, this proposal provides for more certain savings through light level tuning with the option of lumen maintenance control.

Enhanced lighting controls (Section C406.4) can save more energy by tuning maximum light levels to just what is needed throughout the building. Making this requirement explicit and requiring documentation can actually achieve greater savings.

In the proposed code language, changes are made to allow for the following:

- Definitions are added for lumen maintenance controls and high end trim. These definitions are adapted from NEMA-LSD-64. The high end trim definition exactly matches the NEMA definition, and the lumen maintenance definition is adjusted to refer to luminaire power rather than lamp power.
- The area required with the specified controls is adjusted to 90%. Under current language, all luminaires in the building would need to meet the control requirements. This does not make sense for areas like mechanical and electrical rooms, stairwells, and restrooms, where the specified controls would not provide an energy benefit.
- The specified controls are required only for luminaires providing general lighting.
- A requirement for high end trim was added for any areas with lumen maintenance controls, plus 50% of the remaining area.

High end trim or tuning accounts for the fact that maximum lighting with full output at the lighting power allowance level typically provides more lighting than necessary, due to increments in luminaire size and limits on exact luminaire spacing. Requiring tuning that reduces light levels and power by at least 15%, along with documentation in the lighting functional testing process will reduce actual light power levels. While the original language for this type of control provides the capability to tune, without the trim requirement, there is not a strong argument for savings actually occurring. Lumen maintenance controls also start with a lower light level and adjust the lighting upward to compensate for lumen and dirt depreciation. Requiring tuning to 85% or lower will result in more savings than the savings shown for the existing requirement without this trim language. In the field, tuning down to 70% light and power levels or lower is often possible.

This proposal addresses lumen maintenance controlled luminaires, but does not require lumen maintenance controls. Lumen maintenance controls will adjust the lighting power over time to increase power as the light output reduces from lamp, dirt and room lumen depreciation. This strategy can save average energy over time, but only if the controls are tuned initially. When these controls are applied, all areas with lumen maintenance control require tuning, with half the remaining area also requiring high end trim tuning. Where lumen maintenance controls are not used, the high trim requirement applies to 50% of the lit area.

Note: Tables C406.1(1) through C406.1(5) include entries for climate zones 1A through 8. Should climate zones 0A and 0B be added to the IECC, use values for 1A in 0A and values for 1B in 0B.

Bibliography:

Hart, R., R. Nambiar, M. Tyler, M., Y. Xie, and J. Zhang. "Relative Credits for Extra Efficiency Measures: Technical Brief." Pacific Northwest National Laboratory (PNNL), Richland, WA (US), January 2019. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370Rev.1.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal makes the application easier to implement on the one hand. Making the applicability only to 90% of general lighting reduces the cost. Requiring tuning appears to increase the cost; however, it is currently required by C408 in daylighting areas, so the area where tuning is already required could be equivalent to 50% of the lighting area. In all, this proposal is more a clarification and a reinforcement of tuning requirements that are already found for daylighting areas in Section C408.

CE229-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: This is better handled during the public comment, the proponent and opponent are encouraged to work together to resolve differences on Section C406.4 Item 6 (Vote 14-1).

Assembly Action:

None

CE229-19

Individual Consideration Agenda

Public Comment 1:

IECC@: 202 (New), C406.4

Proponents:

Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**LUMEN MAINTENANCE CONTROLS:** A lighting control strategy that adjusts luminaire power over time to maintain constant light output as luminaires age, dirt accumulates or both. This strategy allows for energy savings in the life of the system then increases power as the system ages.~~

~~**HIGH END TRIM:** A lighting control strategy that sets the required maximum light level for each space.~~

C406.4 Enhanced digital lighting controls. At least 90 percent of the building floor area shall have interior lighting with the following enhanced lighting controls for luminaires providing *general lighting*, that shall be located, scheduled and operated in accordance with Section C405.2.

1. Luminaires shall be configured for continuous dimming.
2. Luminaires shall be addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaires shall be allowed.
3. Not more than eight luminaires shall be controlled together in a *daylight zone*.

4. Fixtures shall be controlled through a digital control system that includes the following function:
 - 4.1. Control reconfiguration based on digital addressability.
 - 4.2. Load shedding.
 - 4.3. Individual user control of overhead general illumination in open offices.
 - 4.4. Occupancy sensors shall be capable of being reconfigured through the digital control system.

5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4.

6. Functional testing of lighting controls shall comply with Section C408. *High end trim* controls shall be enabled and configured to limit the initial maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw for ~~both of the following: the general lighting in at least 50% of the floor area.~~
 - ~~6.1. All areas that have lumen maintenance controls~~
 - ~~6.2. 50% of the remaining floor area.~~

Commenter's Reason: The rationale for the proposed change is to simplify the added energy efficiency associated with tuning. Both lumen maintenance controls and institutional tuning both require high end trim (reducing) the initial light output of luminaires. Eventual adjustments that occur over time can be manual or in the case with lumen maintenance controls, automatically. As a result, it is not necessary to have a separate definition of lumen maintenance or to have the extra complexity of subtracting off the area served by lumen maintenance controls to calculate the amount of floor area served by high end tuning without the lumen maintenance controls. The intent is to lower the initial light output or power draw of lighting by at least 15% for general lighting serving 50% of the floor area to receive the energy efficiency credits. High end trim is one of the few lighting features in this section (besides individual user controls in open offices) that actually saves energy. Without the high end trim feature, this measure does not save comparable energy to the 10% LPD reduction.

The 15% percent lighting reduction of lighting power reduction is achievable. This is what was written by a committee of expert lighting designers and researchers in support of the controllable lighting proposal for the 2013 version of California's Title 24 part 6: *"We estimated the potential energy savings from this measure using the methodology described above in Section 3.2.3. Typical lighting installations are designed to provide a higher light level at the start of the lamping cycle, in order to account for lamp lumen depreciation and other light loss factors over lamp life. In addition, the constraints of standard lighting geometries, available luminaire sizes, and lamping usually create a situation in which the lighting designer must specify even higher light levels than are necessary to meet minimum maintained illuminance requirements. Based on these factors, we assume that by tuning lighting to the required level during the initial part of lamp life, a 15% power reduction over the lamping cycle is possible."* (page 20 Benya et al 2011) In response to comments that this is not applicable now to modern lighting systems that use LEDs with lower lumen depreciation, it is worth noting that the new ASHRAE 90.1-2019 LPDs were developed with an across board lamp lumen depreciation of 85%.

If we are moving to an energy equivalent points system, to keep the high level of points that is currently allocated the enhanced digital lighting controls, one would need to either keep the high end trim requirements, or replace this control with another control function that has equivalent savings and is enabled and verified through a functional performance test.

Bibliography: James Benya, PE, Michael Neils, PE, and Francis Rubinstein. Requirements for Controllable Lighting. 2011 California Building Energy Efficiency Standards. March 21, 2011

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment only clarifies and simplifies the original proposal that did not impact the cost of construction.

CE233-19

IECC@: C406.10 (New), SECTION C406, C406.1, C406.1.1

Proposed Change as Submitted

Proponents: Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

2018 International Energy Conservation Code

Add new text as follows:

C406.10 Automation Receptacle Control The following shall be automatically controlled:

1. At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy and/or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3. Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.

This control shall function on:

1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft² and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft
2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or
3. An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.

All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space. Plug-in devices shall not comply.

Exceptions: Receptacles for the following shall not require an automatic control device:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

SECTION C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Automatic receptacle control in accordance with Section C406.10.

C406.1.1 Tenant spaces. Tenant spaces shall comply with Section C406.2, C406.3, C406.4, C406.6, C406.7 or C406.10. Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

Reason: Reason: This proposal will:

1. Increase building energy efficiency

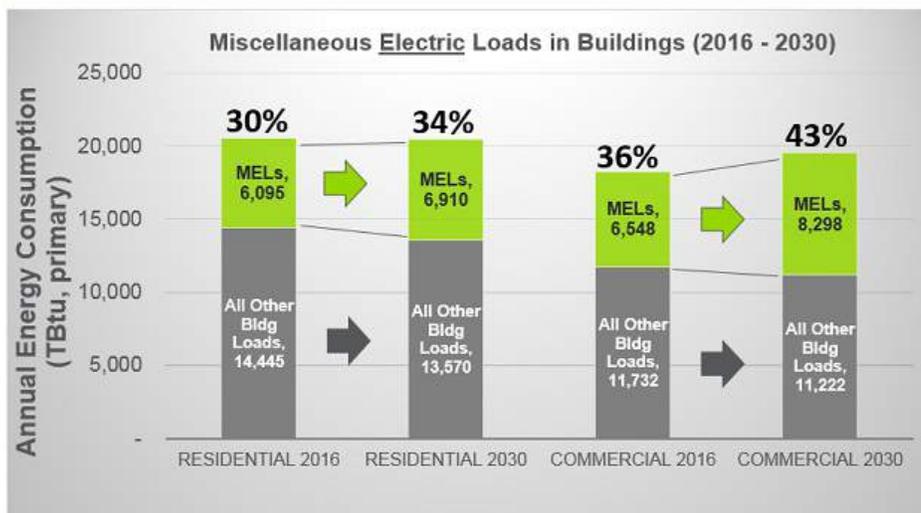
2. Offer a well-studied, cost effective efficiency measure
3. Maintain building occupant's safe usability
4. Keep enforceability simple
5. Align with other energy efficiency codes, increasing design compliance

Although commercial buildings continue to decrease their energy use through more efficient lighting, mechanical, and domestic water systems, the Miscellaneous Electrical Loads (MELs) energy segment continues to rise. More and more electrical power consuming devices are being plugged into building electrical systems. Some, such as fans, space heaters, printers, monitors, plug in lamps are left on, when spaces are unoccupied. Other devices may be left plugged in and continue to draw power even when inactive or in standby modes. This wastes energy and is counter to the energy efficiency aim of the IECC.

Some jurisdictions which adopt the IECC for their commercial buildings, like Florida and Washington, have amended the IECC to include automatic receptacle control, thereby addressing the growing energy consumption concern of these loads. For more than eight years, other energy efficiency codes have included automatic receptacle control provisions to reduce the wasted energy. Yet, the IECC lags behind offering no viable solution to the growing receptacle and miscellaneous loads on commercial building electrical systems. The Annual Energy Outlook of 2015 from the US EIA, indicate that these load categories will grow from 36% of a commercial buildings energy use, to 43% over the next 15 years.

Miscellaneous Electric Loads vs Total Building Energy Use

According to EIA Annual Energy Outlook (AEO, 2015), under business-as-usual scenario, contribution of Miscellaneous Electric Loads (MELs, electric) to total building energy consumption is projected to increase from 30% to 34% for the residential sector and from 36% to 43% for the commercial sector for 2016 – 2030.



EIA Annual Energy Outlook, 2015

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

This provision simply assures receptacle loads that are not needed when building occupants leave high receptacle load use areas, are automatically turned off, saving the energy that would otherwise be wasted. It requires that controlled receptacles clearly be marked as required by NFPA 70, to eliminate user confusion of proper use, and provides good practice exceptions where controlling receptacles would endanger safety and security, or areas of continuous operation.

Expressed safety concerns where extensive use of extension cords and plug strips would be used are unfounded. There are no documented studies validating this problem exists. The proposed language requires either a split duplex receptacle with a controlled or uncontrolled receptacle in the same device, or an uncontrolled receptacle be located no more than 12 inches from a controlled receptacle. This provides occupants in an automatic receptacle-controlled space, clear access to both label marked controlled receptacles and uncontrolled receptacles.

Although there are no requirements for receptacle density in commercial buildings, a design professional will ensure there is an appropriate distribution of receptacles to effectively accomplish the mission of the building. There's no evidence that the distribution of receptacle outlets and controlling some of them has any adverse impact on the utility of this requirement.

Enforceability of this provision is straight forward for building departments and their inspectors. Construction drawings indicate which receptacles are controlled and which are uncontrolled. Onsite inspection will clearly show complying labelled receptacles and operation is easily varied with the shut-off controls already in place with the lighting system.

There have been a considerable number of studies over the years that share the viability and cost effectiveness of automatic receptacle control. Some noted here.

1. One study demonstrated effectiveness (e.g. Zhang2012) with simply payback on this type of equipment between 1.5 and 9 years for small and large offices. This considers the most comprehensive information on office plug load types, installation densities, usage patterns, and power states based on field surveys and monitoring (Kawamoto 2000, 2001; Moorefield, Frazer & Bendt 2011; Roberson 2002, 2004; Roth 2002, 2004; Sanchez 2007; Webber 2001, 2005).
2. A CASE initiative study for CA Title 24-2013 found that smaller office buildings (10,000 sqft) had an annual electrical savings of 4,900 kwh/year and a demand savings of 1.97 kW. Based on installed costs and utilization of lighting control system elements already installed. The simple payback was 4.2 years. For larger office buildings (175,000 sqft) the annual electrical savings were 107,000 kwh/year and a demand savings of 23.6 kW for a simple payback of 2.4 years.
3. A GSA Green Proving Ground Program study conducted in 8 buildings with monitored receptacle control through market available plug strips found "Results underscored the effectiveness of schedule-based functionality, which reduce plug loads at workstations by 26%, even though advanced computer power management was already in place, and nearly 50% in printer room and kitchens." In the study buildings, receptacle loads averaged 21% of building energy use and monitored more than 295 devices over three different test periods to validate the findings. It found payback through timer scheduled control of kitchens of 0.7 years, printer rooms of 1.1 years and miscellaneous devices in 4.1 years. At workstations, the payback was 7.8 years.
4. A study done on "Office Space Plug Load Profiles and Energy Savings Interventions" at the University of Idaho and presented at the ACEEE summer Study in 2012 found that average savings of 0.60 kWh/SF Yr. with plug strip control interventions. This study provided guidance for utility programs to assist with development of plug load efficiency measures and was based on a more detailed report, "Plug Load Profiles" (Acker, B. et. al. 2012).
5. The DOE Better Buildings program issued a December 2015 "Decision Guides for Plug and Process Loads Controls" to help educate and guide decision processes for effective receptacle-based load control. It highlights that "Plug and Process Loads" account for 33% of the total energy consumed by commercial buildings. It sites seven decision strategies including that of Integrated plug load controls with other building systems as one of the largest for energy savings across most building types for whole-building retrofit and new construction categories.
6. A study performed "Advancing the Last Frontier – Reduction of Commercial Plug Loads" presented at the ACEEE summer study of 2016, indicated field study results demonstrating savings of 19% when deploying plug in control strategies in office workstation environments.

Cost Impact: The code change proposal will increase the cost of construction Costs estimated to be \$0.26/ft² for small office implementation and \$0.19/ft² for large office. Payback estimated at 4.2 years for small office buildings (10,000sqft) and 2.4 years for large office buildings (100,000sqft). Source: 2013 California Building Energy Efficiency Standards CASE report.

CE233-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: Due to the decision to get it into requirements, the proponent requested disapproval, and prior action on CE216. A public comment is needed to address the issues raised in CE216 (Vote: 15-0).

Assembly Action:

None

CE233-19

Individual Consideration Agenda

Public Comment 1:

IECC@: SECTION C406, C406.1, C406.1.1, C406.10 (New), C406.10.1 (New)

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Automatic receptacle control in accordance with Section C406.10.

C406.1.1 Tenant spaces. Tenant spaces shall comply with Section C406.2, C406.3, C406.4, C406.6, C406.7 or C406.10. Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.10 Automation Receptacle Control The following shall ~~have be~~ automatically ~~receptacle control sled~~ complying with section C406.10.1 :

1. At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy and/or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
- ~~3. Either split-controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.~~

~~This control shall function on:~~

- ~~1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft² and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft~~

- ~~2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or~~
- ~~3. An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.~~

~~All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space. Plug-in devices shall not comply.~~

Exceptions: Receptacles for the following shall not require an automatic control device:

- ~~1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).~~
- ~~2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.~~
- ~~3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.~~

C406.10.1 Automatic receptacle control function. Automatic receptacle controls shall comply with the following:

1. Either split controlled receptacles shall be provided with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.
2. Each controlled receptacle shall be controlled by one of the following methods:
 - 2.1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft² square feet and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ftsquare feet.
 - 2.2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or
 - 2.3 An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.
3. All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space.

Exceptions: Automatic receptacle controls are not required for the following:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

Commenter's Reason: This Public Comment allows an Automatic Receptacle Control provision as an additional efficiency option to be heard in public comment hearings in the event a mandatory provision is not approved. This would NOT be heard if the mandatory provision, already approved as modified during the Committee Action Hearings, remains approved as modified during the Public Comment Hearings. The public comment language changes herein, reflects the Floor Modifications approved at the earlier Committee Action Hearings.

The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This code change proposal will only increase the cost of construction if chosen as an Additional Efficiency Package Option. Costs estimated to be \$0.26/ft² for small office implementation and \$0.19/ft² for large office. Payback estimated at 4.2 years for small office buildings (10,000sqft) and 2.4 years for large office buildings (100,000sqft). Source: 2013 California Building Energy Efficiency Standards CASE report.

Public Comment# 1439

CE237-19

IECC@: C406.1, C406.10 (New), C406.10.1 (New), C406.10.2 (New), TABLE 406.10.2 (New), C406.10.3 (New), C406.10.4 (New), C406.10.5 (New)

Proposed Change as Submitted

Proponents: Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Include an energy monitoring system in accordance with C406.10

Add new text as follows:

C406.10 Energy Monitoring Buildings shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section C406.10.1 through C406.10.5.

C406.10.1 Electrical energy metering. For electrical energy, including all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities, and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C406.10.2.

C406.10.2 End-use metering categories. Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category listed in Table 406.10.2. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories listed in Table 406.10.2 is permitted to be from a load not within the category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit does not require end-use metering.
2. End-use metering is not required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.

**TABLE 406.10.2
ENERGY USE CATEGORIES**

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC system	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior lighting	Lighting systems located within the <i>building</i> .
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process loads	Any single load that is not included in a HVAC, lighting, or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors.

C406.10.3 Meters. Meters or other measurement devices required by this Section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C406.10.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of +/-2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections 406.10.4 and C406.10.5.

C406.10.4 Data acquisition system. A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C406.10.2.

C406.10.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C406.10.2 at least every hour, day, month and year for the previous 36 months.

Reason: The investment made for the infrastructure of a building in order to comply with the IECC is significant. The assumption that is currently made upon commissioning a facility is that energy efficiency measures will not degrade, or go out of calibration, over time and their energy consumption will not increase as time passes from the time they were commissioned. Such an assumption is completely inaccurate and any payback assumed for energy efficient infrastructure investments will be lengthened, thereby reducing the ROI and increasing the payback period. The only means to retain the energy performance of a building is to continuously monitor energy consumption levels of various energy consuming

systems and compare them to previous levels. Monitoring sub-systems provides key indications when changes have been made or systems are not operating to specification, which increases energy consumption. Examples include, but are not limited to:

1. Increased energy consumption in HVAC system loads will point to failures in motors, drive systems, bearings, etc.

2. Degrading building envelope

3. Configuration changes to the building that may drive increased energy consumption.

4. Increase of energy consumption from lighting loads may indicate changes in arrangement of the office space that resulted in reduced lighting loads may indicate change in arrangement of the office space that resulted in reduced lighting driving the installation of more lighting above permitted energy code levels, failure of occupant sensors, inappropriate lighting schedules, lamps that need to be replaced or cleaned, etc.

5. Monitoring plug loads will indicate then computer equipment is left on during non-working hours and use of space heaters that compromise the efficiency of the facility due to set points on the HVAC system.

The requirements in this proposal save energy by continually monitoring and reporting actionable energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plug loads). There are well documented studies that demonstrate the energy savings from metering and monitoring systems. Several state energy codes have recognized the benefits and require energy monitoring to support a continual high level of performance from the energy efficient investment.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change proposal "will" increase the cost of construction because it will require additional hardware, software and labor during installation.

Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings: https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

CE237-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Modified

Committee Modification:

C406.1 Additional energy efficiency credit Requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Where not required by Section C405.10 + include an energy monitoring system in accordance with C406.10.

Table C406.1(1) Additional Energy Efficiency Credits for Group B Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	4	4	4	4	3	3	3	3	3	3	2	3	2	2	2	2	2

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	3	3	3	3	3	3	3	3	3	2	2	3	2	2	2	2	2

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	4	5	5	5	5	4	4	4	4	3	3	4	3	4	4	4	3

Table C406.1(5) Additional Energy Efficiency Credits for Other^a Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	3	3	3	3	3	3	3	3	3	3	2	3	2	2	2	3	2

^a Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

Committee Reason: This is consistent with actions on CE215 but for smaller buildings. Suggested a public comment to include tenant access to reports in Section C406.10.5. The modification corrects language of the proposal to align with CE215 (Vote: 11-4).

Assembly Action:

None

CE237-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.1

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of

C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. ~~Where not required by Section C405.10 include an e~~Energy monitoring system in accordance with C406.10.

Commenter's Reason: This Public Comment allows language modifications to CE237 (an additional efficiency option Energy Monitoring proposal), to be heard in the public comment hearings, in the event a mandatory provision is not approved. This public comment will not be called to the floor if the mandatory provision, already approved as modified during the Committee Action Hearing, remains approved. The public comment language changes are needed to properly apply energy monitoring as an additional efficiency package option when there is no mandatory requirement (as was approved in the Committee Action Hearing).

The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal will only increase the cost of construction if chosen as an Additional Efficiency Package Option. Implementation requires additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings:

https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

Public Comment# 1455

Public Comment 2:

IECC@: C406.10.5 (New)

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.10.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel, building owner, and the tenant of each space. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C406.10.2 at least every hour, day, month and year for the previous 36 months.

Commenter's Reason: The original proposal does have some merits as an option. The modification made was to address who receives the reports for the energy use of the building or space. The intent is to monitor the energy usage to be cognitive of how much and how the energy is used within the building or space, but the original proposal left out key players in the mix. If the tenants of the space or owners of the building are not provided with this information they are not able to address any concerns of how one may be wasting energy. Knowledge is power, and this knowledge needs to be provided where it can be useful and used appropriately. If one does not know how much energy is being used one can not fix any wasting measures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The public comment is only a clarification and clarifications do not have a cost impact. Therefore, the net effect of the public comment and the proposal is the cost increase reason in the original proposal.

Public Comment# 1540

Public Comment 3:

IECC@: C406.1, Table C406.1(1) (New), TABLE (New)

Proponents:

Wayne Stoppelmoor, representing NEMA (wayne.stoppelmoor@schneider-electric.com); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 ~~Additional energy efficiency credit~~ Requirements New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building compl_yies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C405.10 include an energy monitoring system in accordance with C406.10.

Table G406.1(1)
Additional Energy Efficiency Credits for Group B Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Energy Monitoring	4	4	4	4	3	3	3	3	3	3	2	3	2	2	2	2	2

**TABLE G406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Energy Monitoring	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

TABLE G406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Energy Monitoring	3	3	3	3	3	3	3	3	3	2	2	3	2	2	2	2	2

TABLE G406.1(4)
Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Energy Monitoring	4	5	5	5	5	4	4	4	4	3	3	4	3	4	4	4	3

**TABLE G406-1(5)
Additional Energy Efficiency Credits for Other^a Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Energy Monitoring	3	3	3	3	3	3	3	3	3	3	2	3	2	2	2	3	2

^aOther occupancy groups include all Groups except for Groups B, R, I, E, and M.

Commenter's Reason: This Public Comment allows modifications to the proposed additional efficiency option for Energy Monitoring, to be heard in public comment hearings, in the event CE218 (C406 Additional Efficiency Package Option credit system) is not approved. This would NOT be brought to the floor if CE218 and CE215 maintain approval as modified during the Committee Action Hearing. The public comment language changes are needed to properly apply energy monitoring as an additional efficiency option when there is no C406 credit system as proposed in CE218 (approved as modified at the Committee Action Hearing).

The reason statement for energy savings and costs analysis is the same as presented in the original proposal

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal will only increase the cost of construction, if chosen as an Additional Efficiency Package Option. Implementation will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings:

https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

Public Comment# 1460

Public Comment 4:

Proponents:

Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Submitted

Commenter's Reason: This Public Comment allows the language of CE237 to revert back to its original proposed language and to be heard in the public comment hearings in the event the mandatory provision (CE215) and additional efficiency credit system (CE218) are not approved. This public comment will not be called to the public comment hearing floor if the mandatory provision (approved at the Committee Action Hearings) and the additional efficiency credit system (approved at the Committee Actions Hearings) remain approved.

The reason statement for energy savings and costs analysis is the same as presented in the original proposal

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The code change proposal will only increase the cost of construction if chosen as an Additional Efficiency Package Option. Implementation requires additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings:

https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

Public Comment# 1873

CE238-19

IECC: C202 (New), C406.1, C406.10(New), C406.10.1(New)

Proposed Change as Submitted

Proponents: Sharon Bonesteel, representing Salt River Project (sharon.bonesteel@srpnet.com); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

SECTION C202 GENERAL DEFINITIONS

Add new definition as follows:

ELECTRICAL ENERGY STORAGE SYSTEM (EESS). A system used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities in accordance with Section 1206 of the *International Fire Code*.

LOAD. A portion of a system that consumes electric energy. The total electrical *load* of a building is the sum of all electricity consuming appliances, lights and systems, necessary for a building to function as designed.

ON-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the highest and when the maximum generation resources are required to supply electricity to the customer.

OFF-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the lowest and when generation resources are being underutilized.

ENERGY MANAGEMENT SYSTEM. An electronic system that protects stationary storage batteries from operating outside of their safe operating parameters, and generates an alarm and trouble signal for off normal conditions.

SECTION C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Provision of an electrical energy storage system (EESS) controlled via an energy management system that shall be programed to shift a portion of the building load from on-peak to off-peak, in accordance with Section C406.10.

Add new text as follows:

C406.10 Electrical energy storage system (EESS). EESS shall be controlled by an energy management system that is programmed to shift the load from on-peak to off-peak.

C406.10.1 System storage capabilities. The system shall be capable of storing the following:

1. Not less than 0.05 watts per square foot (0.54 W/m²) of conditioned floor area.
2. Not less than 10 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Reason: The conservation of energy and its related cost are the foundation of the IECC. Demand charges make a large impact on a businesses' utility bill. The inclusion of energy storage will allow these businesses to shift that load from on-peak (most expensive per kw) to off-peak (least expensive per kw) and thus reduce their demand charges. Utilizing off-peak energy to charge up the energy storage for use during on-peak times results in efficient use of the energy generation facilities available to the business.

Definitions that are common in the utility world are not defined in the codes. Utilities clearly indicate on their websites the on-peak and off-peak hours, as well as the cost difference between a kw based upon the time of use. Referencing definitions for EESS from the 2018 IFC and Load calculations clearly being defined in 2017 NFPA Art.220.40, facilitates consistency between codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This code change provides another option within Section C406, allowing businesses to utilize their energy efficiently. The shift of a load from on-peak period to off-peak is an important aspect of the effective use of energy. This code change also provides definitions that are common in the utility world and are necessary for the inclusion of energy storage in the effective use of energy. Referencing definitions in the IFC and the NEC facilitate consistency between codes.

CE238-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is too much confusion over issues which reference the IFC and electrical storage (Vote: 10-5).

Assembly Action:

None

CE238-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.10.1 (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org); Sharon Bonesteel AIA CBO CP, salt river project, representing Salt River Project (sharon.bonesteel@srpnet.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.10.1 System storage capabilities. The system shall be capable of storing the following:

1. Not less than ~~0.05~~ 0.5 watts per square foot (~~0.54~~ 5.4 W/m²) of conditioned floor area, and
2. Not less than ~~10~~ 0.1 percent of the annual energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Energy efficiency credit: Electrical Energy Storage Systems shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This modification improves the proposal by doing the following:

-It modifies the system storage requirements. According to EIA data from CBECS 2012, the average commercial building uses 14.6 kWh / square foot of electricity per year. The typical peak demand is around 5-6 Watts per square foot for less energy intensive buildings (offices, retail, etc.). For a 10,000 square foot commercial building, 0.5 W/sf for the storage system is equal to 5 kW (compared to the building peak demand of 50 to 60 kW). If the building mechanical, water heating, and lighting equipment use 50% of the total electricity in the building, then they use 73,000 kWh per year (50% of 10,000 sf * 14.6 kWh/sf). The revised requirement of 0.1% of the annual energy used is equal to a storage system with a total capacity of 73 kWh.

-It provides information for the credit calculations that were approved in CE 218. Electrical energy storage systems will provide the same service or services in all buildings located in any climate zone, which is the reason for the same credit for all building types and all climate zones.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This public comment revises the proposed new option based on more recent information about electrical storage needs. This is only a clarification that does not affect the proposal's cost impact statement.

CE239-19

IECC: C202, C406.1, C406.10 (New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Add new definition as follows:

FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM. A software platform that utilizes building analytic algorithms to convert data provided by sensors and devices to automatically identify faults in building systems and provide a prioritized list of actionable resolutions to those faults based on cost or energy avoidance, comfort and maintenance impact.

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Include a fault detection and diagnostics (FDD) system in accordance with Section C406.10.

Add new text as follows:

C406.10 Fault detection and diagnostics system. A fault detection and diagnostics system shall be installed to monitor the HVAC system's performance and automatically identify faults. The system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;
4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of the HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Reason: Energy efficiency of a new building's HVAC system will degrade over time caused by poorly maintained, failing and improperly controlled equipment. The proposed FDD requirement will reduce that degradation by detecting HVAC system faults and notifying building operators so that actions may be taken to reduce energy consumption of the building. Additionally, FDD systems are being utilized to drive operational efficiency, make better use of maintenance personnel, and resolve comfort issues.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it "will" increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link <https://ecobuilding.schneider-electric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25>: Setup/install cost - \$23,190, Annual maintenance cost - \$35,407, and Annual savings - \$286,000.

CE239-19

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

C406.1 Additional energy efficiency credit R requirements. Buildings shall comply. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant

subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C403.2.3 include a fault detection and diagnostics (FDD) system in accordance with Section C406.10.

Table C406.1(1) Additional Energy Efficiency Credits for Group B Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	1	1	1	1	1	1	NA	1	1	NA	1	1	NA	1	1	1	1

Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2

Table C406.1(5) Additional Energy Efficiency Credits for Other^a Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

^aOther occupancy groups include all Groups except for Groups B, R, I, E, and M.

Committee Reason: This aligns with 218 14-0 This allows credit for this provision in those buildings that aren't required to have it. The modification provides alignment with CE218 (Vote 14-1).

Assembly Action:

None

CE239-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.1

Proponents:

Harold Jepsen, Legrand, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. ~~Where not required by Section C403.2.3 include a~~ Fault detection and diagnostics (FDD) system in accordance with Section C406.10.

Commenter's Reason: This Public Comment allows language modifications to CE239 (an additional efficiency option Fault Detection Diagnostic proposal), to be heard in the public comment hearings, in the event a mandatory provision is not approved. This public comment will not be called to the floor if the mandatory provision, already approved as modified during the Committee Action Hearing, remains approved. The public comment language changes are needed to properly apply fault detection diagnostics as an additional efficiency package option when there is no mandatory requirement (as was approved in the Committee Action Hearing).

The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it will increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link <https://ecobuilding.schneiderelectric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25>: Setup/install cost of \$23,190, Annual maintenance cost of \$35,407, and Annual savings of \$286,000.

Public Comment# 1888

Public Comment 2:

IECC@: C406.1, TABLE (New),

TABLE

(New), Table (New)

Proponents:

Wayne Stoppelmoor (wayne.stoppelmoor@schneider-electric.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

~~C406.1 Additional energy efficiency credit~~ Requirements.

New buildings shall ~~achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies~~ comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C403.2.3 include a fault detection and diagnostics (FDD) system in accordance with Section C406.10.

TABLE G406.1(1)
Additional Energy Efficiency Credits for Group B Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Fault Detection	2	2	2	2	+	+	+	+	+	+	+	+	+	+	+	+	+

TABLE G406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Fault Detection	+	+	+	+	+	+	NA	+	+	NA	+	+	NA	+	+	+	+

**TABLE G406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Fault Detection	+	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	2

TABLE

G406.1(4)

Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G406.10 Fault Detection	2	2	2	2	+	+	+	+	+	+	+	+	+	+	+	2	2

**Table C406.1(5)
Additional Energy Efficiency Credits for Other^a Occupancies**

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	+	+	+	+	+	+	+	+	+	+	+	+	+

^aOther occupancy groups include all Groups except for Groups B, R, I, E, and M.

Commenter's Reason: This Public Comment allows language modifications to CE239 (an additional efficiency option Fault Detection Diagnostic proposal), to be heard in the public comment hearings, in the event CE218(C406, additional efficiency package option credit system) is not approved. This public comment will not be called to the floor if CE218 and CE111 maintain approval as modified during the Committee Action Hearing. The public comment language changes are needed to properly apply fault detection diagnostics as an additional efficiency package option when there is no C406 credit system as proposed in CE218.

The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it "will" increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link

<https://ecobuilding.schneiderelectric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25>: Setup/install cost of \$23,190, Annual maintenance cost of \$35,407, and Annual savings of \$286,000.

Public Comment# 1894

Public Comment 3:

Proponents:

Harold Jepsen, Legrand, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

requests As Submitted

Commenter's Reason: This Public Comment allows the language of CE239 to revert back to its original proposed language and to be heard in the public comment hearings in the event the mandatory provision (CE111) and the C406 additional efficiency package option credit system (CE218) are not approved. This public comment will not be called to the public comment hearing floor if the mandatory provision (approved at the Committee Action Hearings) and the additional efficiency credit system (approved at the Committee Actions Hearings) remain approved.

The reason statement for energy savings and cost analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it "will" increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link

<https://ecobuilding.schneiderelectric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25>: Setup/install cost of \$23,190, Annual maintenance cost of \$35,407, and Annual savings of \$286,000.

Public Comment# 1901

CE240-19

IECC@: SECTION C406, C406.1, Table C406.1(1) (New), Table C406.1(2) (New), Table C406.1(3) (New), Table C406.1(4) (New), Table C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.5, C406.5.1, C406.5.2 (New), C406.7, C406.7.1, C406.7.2, C406.7.3 (New), C406.7.4 (New), C406.10 (New), Table C406.10(1) (New), Table C406.10(2) (New), Table C406.10(3) (New), Table C406.10(4) (New), ASTM Chapter 06 (New)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

SECTION C406

ADDITIONAL EFFICIENCY PACKAGE OPTIONS REQUIREMENTS

C406.1 Requirements- Additional energy efficiency requirements ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits may also be as calculated in accordance the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Efficient Kitchen Equipment in accordance with Section C406.10.

Add new text as follows:

Table C406.1(1)
Additional Energy Efficiency Credits for Group B Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406.2.1: 5% Heating Eff Imprv.	NA	1	NA	NA	1	1	NA	1									
C406.2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10 % Heating Eff Imprv.	NA	1	NA	NA	2	1	1	2	2	NA	1						
C406.2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406.7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406.7.4: Heat Pump SWH	NA	NA	NA	NA													
C406.8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

Table C406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3: Reduced Light Power	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

Table C406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406 .2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406 .3: Reduced Light Power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406 .6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA													
C406 .7.2: Recovered/Renew SWH ^a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH ^a	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH ^a	NA	1	NA	NA	1	1	NA	1	1	1	1						
C406 .8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406 .9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

^a for schools with full service kitchens or showers

Table C406.1(4)
Additional Energy Efficiency Credits for Group M Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3: Reduced Light Power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA													
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA													
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA													
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA													
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

Table C406.1(5)
Additional Energy Efficiency Credits for Other^a Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406 .2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406 .2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406 .3: Reduced Light Power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egv.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406 .7.2: Recovered/Renew SWH ^b	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH ^b	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH ^b	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406 .9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

b. For occupancy groups listed in C406 .7.1.

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options from Tables C406 .1(1) through C406 .1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. Alternatively, C406.7 or C406.10. Where the entire building complies using credits from Section C406 .5, C406 .8 or C406 .9, tenant spaces within the building shall be deemed to comply with Section C406.5 where the entire building is in compliance with this section.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. C403.3.2(9) and Variable refrigerant flow systems shall exceed listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. Equipment in accordance with Sections C406 .2.1, C406 .2.2, C406 .2.3 or C406 .2.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2 or C406.2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) C403.3.2(9) and Variable refrigerant flow systems not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system capacity capacity for heating equipment where selecting C406.2.1 or C406.2.3 and cooling equipment where selecting C406.2.2 or C406.2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.5 On-site renewable energy. Buildings shall comply with Section C406 .5.1 or C406 .5.2. The total minimum ratings of on-site renewable energy systems shall be one of the following:

1. Not less than 1.71 Btu/h per square foot (5.4 W/m²) or 0.50 watts per square foot (5.4 W/m²) of conditioned floor area.
2. Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

~~C406.5~~ **C406.5.1 On-site Basic renewable energy- credits** The total minimum ratings of on-site renewable energy systems not including systems used for credits under Section C406.7. shall be one of the following:

1. Not less than ~~4.74~~0.86 Btu/h per square foot (~~5.4~~2.7 W/m²) or ~~0.50~~0.25 watts per square foot (~~5.4~~2.7 W/m²) of conditioned floor area.
2. Not less than ~~3~~2 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Add new text as follows:

C406.5.2 Enhanced Renewable Credits Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406 .5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$$AEEC_{RRa} = AEEC_{2.5} \times RRa / RR1 \text{ (Equation 4-13)}$$

Where:

$AEEC_{RRa}$ = C406.5.2 additional energy efficiency credits

RRa = actual total minimum ratings of *on-site renewable energy* systems in Btu/h, watts per square foot or W/m²)

$RR1$ = minimum ratings of *on-site renewable energy* systems required by C406.5.1(1) in Btu/h, watts per square foot or W/m²)

$AEEC_{2.5}$ = C406.5.1 credits from Tables C406.1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Sections C406 .7.1 and either C406 .7.2, C406 .7.3 or C406 .7.4.

~~C406.7~~ **C406.7.1 Reduced energy use in service water heating- Building Type** Buildings shall be of the following types to use this compliance method To qualify for this credit, the building shall contain one of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups:

1. *Group R-1:* Boarding houses, hotels or motels.
2. *Group I-2:* Hospitals, psychiatric hospitals and nursing homes.
3. *Group A-2:* Restaurants and banquet halls or buildings containing food preparation areas.
4. *Group F:* Laundries.
5. *Group R-2.*
6. *Group A-3:* Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~C406.7.1~~ **C406.7.2 Load fraction- Recovered or renewable water heating** The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~30 percent of the building's annual hot water requirements, or sized to provide ~~40~~70 percent of the building's annual hot water requirements if the building ~~shall otherwise be required to comply with Section C403.9.5:~~

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0 .95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0 . Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

C406.10 Efficient Kitchen Equipment For buildings and spaces designated as Group A-2 or facilities that include a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve performance levels in accordance with the equipment specifications listed in Tables C406.10(1) through C406.10(4) when rated in

- accordance with the applicable test procedure.
2. Be installed prior to the issuance of the Certificate of Occupancy.
 3. Have associated performance levels listed on the construction documents submitted for permitting.

Energy efficiency credits for efficient kitchen equipment shall be independent of climate zone and determined based on Equation 4-14, rounded to the nearest whole number.

$$\underline{AEEC_K = 20 \times Area_K / Area_B \text{ (Equation 4-14)}}$$

Where:

$$\underline{AEEC_K = C406.10 \text{ additional energy efficiency credits}}$$

$$\underline{Area_K = \text{Floor area of full service kitchen (ft}^2 \text{ or m}^2\text{)}}$$

$$\underline{Area_B = \text{Gross floor area of building (ft}^2 \text{ or m}^2\text{)}}$$

Table C406.10(1)
Minimum Efficiency Requirements: Commercial Fryers

Fryer Type	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-Fat Gas Fryers	≥ 50%	≤ 9,000 Btu/hr	ASTM Standard F1361-17
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	ASTM Standard F2144-17
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	

Table C406.10(2)
Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency^a	Idle Rate	Test Procedure
Electric Steam	3-pan	50%	400 watts	ASTM Standard F1484-18
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	
Gas Steam	3-pan	38%	6,250 Btu/h	
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity.

Table C406.10(3)
Minimum Efficiency Requirements: Commercial Dishwashers

Machine Type	High Temp Efficiency Requirements		Low Temp Efficiency Requirements		Test Procedure
	Idle Energy Rate^a	Water Consumption^b	Idle Energy Rate^a	Water Consumption^b	
<u>Under Counter</u>	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	ASTM Standard F1696-18
<u>Stationary Single Tank Door</u>	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
<u>Pot, Pan, and Utensil</u>	≤ 1.20 kW	≤ 0.58 GPR	≤ 1.00 kW	≤ 0.58 GPSF	
<u>Single Tank Conveyor</u>	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	ASTM Standard F1920-15
<u>Multiple Tank Conveyor</u>	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	
<u>Single Tank Flight Type</u>	Reported	$GPH \leq 2.975x + 55.00$	Reported	$GPH \leq 2.975x + 55.00$	
<u>Multiple Tank Flight Type</u>	Reported	$GPH \leq 4.96x + 17.00$	Reported	$GPH \leq 4.96x + 17.00$	

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption shall not be part of this measurement unless it cannot be separately monitored.

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L) /min (max conveyor speed).

Table C406.10(4)
Minimum Efficiency Requirements: Commercial Ovens

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure
Convection Ovens				
	Full-Size	≤ 12,000 Btu/h	≥ 46	
Electric	Half-Size	≤ 1.0 Btu/h	≥ 71	ASTM F1496-13
	Full-Size	≤ 1.60 Btu/h		
Combination Ovens				
	Steam Mode	≤ 200P ^a +6,511 Btu/h	≥ 41	ASTM F2861-17
	Convection Mode	≤ 150P ^a +5,425 Btu/h	≥ 56	
Electric	Steam Mode	≤ 0.133P ^a +0.6400 kW	≥ 55	
	Convection Mode	≤ 0.080P ^a +0.4989 kW	≥ 76	
Rack Ovens				
	Single	≤ 25,000 Btu/h	≥ 48	ASTM F2093-18
	Double	≤ 30,000 Btu/h	≥ 52	

a. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F1495-14a standard specification.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1361-17: Standard Test Method for Performance of Open Deep Fat Fryers

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F2144-17: Standard Test Method for Performance of Large Open Vat Fryers

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1484-18: Standard Test Method for Performance of Steam Cookers

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1696-18: Standard Test Method for Energy Performance of Stationary-Rack,Door-Type Commercial Dishwashing Machines

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1920-15: Standard Test Method for Performance of Rack Conveyor Commercial Dishwashing Machines

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1496-13: Standard Test Method for Performance of Convection Ovens

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F2861-17: Standard Test Method for Enhanced Performance of Combination Oven in Various Modes

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F2093-18: Standard Test Method for Performance of Rack Ovens

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1495-14a: Standard Specification for Combination Oven Electric or Gas Fired

Reason: C406 Credits for Efficient Kitchen Equipment

Kitchen equipment uses a large share of building energy use in restaurants, schools, dormitories, hotels, and other facilities with full service kitchens. More efficient equipment saves energy by improving the heat transfer to the cooking process, either through better equipment insulation or other innovations in the appliances. This proposal provides more flexibility to building designers when it is added to the energy efficiency credit choices. It specifically addresses the large energy use of kitchen equipment.

This proposal allows credit for efficient kitchen equipment in Section C406 where extra efficiency options are required. There is a separate proposal that modifies Section C406 from the current requirement to select one of the listed options, to assigning credits to each measure and requiring a certain number of credits (CE218-19). For clarity, that proposal is included here. In addition to the changes that are the same as that proposal, this proposal adds:

- Requirements for a new kitchen equipment efficiency option.
- A formula to calculate the extra efficiency credits based on the ratio of kitchen area to building area.
- Adding the reference to the new kitchen equipment efficiency credits in the tenant section (C406.1.1).

Bibliography:

Hart, R., R. Nambiar, M. Tyler, M., Y. Xie, and J. Zhang. "Relative Credits for Extra Efficiency Measures: Technical Brief." Pacific Northwest National Laboratory (PNNL), Richland, WA (US), January 2019. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370Rev.1.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC Section C406. The intention is to identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. There is not expected to be an increased cost, as this simply increases the options for C406 beyond what is included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM F1361-17, F2144-17, F1484-18, F1696-18, F1920-15, F1496-13, F2861-17, F2093-18 and F1495-14a with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

CE240-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: This adds efficiency options for high energy use equipment. Would like to see a public comment to include all CA ES appliances, and address poor code language (Vote: 14-1).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Proposals CE218, CE226, and CE240 should be withdrawn by the proponent because they do the opposite of what is intended, and a cost justification was not included. The analysis does attempt to balance out equal energy performance, but it does not take into consideration the cost impact of having to comply with multiple choices of the current code which currently requires only one of the listed efficiency options. For example, choose either 10% HVAC equipment efficiency increase or Reduced Light Power or one of the other 6 options and comply with the code. It is also very difficult to determine code compliance for builders building in multiple zones, because the point system varies drastically across zones and what can be used as a solution in one zone will not receive enough points to qualify in other zones. The following are examples of the combinations of requirements that would be required to comply with the proposed change.

Notes:

1. Changes, in all but Option 4, are based on taking the lowest number or total points available to determine compliance.
2. Numerous options are available beyond the examples shown below. The following is just a sample of the difficulty and if cost were applied to the change the cost impact.

Option 1 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:
2. Provide onsite Renewable Energy in all Zones.
3. Plus, include Reduced Lighting Power of 10% in Zones 3C, 4C and 5C.

Option 2 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:
2. Provide Reduced Lighting Power of 10% in all Zones.
3. Plus, Zone 1B also include a Dedicated Outdoor Air System.
4. Plus, Zones 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5C, 6B, and 7 the builder would be required to include a Heat Pump Water Heater. Zone 3C would also need to include Enhanced Envelope Performance.
5. Zones 1A, 2B, 4C, 5B, and 6A could have an Enhanced Envelope in place of the Heat Pump Water Heater and Zones 4C and 5C would also be required to have Reduced Air Infiltration.
6. Zone 8 would only need to have Reduced Air Infiltration.

Option 3 – 5% Increase Equipment Efficiency.

1. In addition to the 5% HVAC equipment efficiency which the justification states will help in compliance because it is difficult to get a 10% increase in HVAC equipment efficiency the builder would need to:
2. Provide On-Site Renewable Energy.
3. Plus, in Zones 3A, 3B, 4B, 4C, and 5C also Reduce Lighting Power by 10%.
4. Zones 4A, 5A, 5B, 6B, 7 and 8 do not need to have Reduce Light Power of 10%, but they must have Lamp Efficacy.

5. And, Zone 3C can get by with only adding Enhance Envelope to the On-Site Renewable Energy requirement.

Option 4 – If the above is complicated and hard to determine then compliance can be obtained by:

1. Installing 5% Increase HVAC Equipment Efficiency, and
2. Installing a Recovered or Renewable Water Heating System for the entire project.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1216

CE242-19

IECC@: C406.1, C406.11 (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Electric Vehicle Supply Equipment in accordance with Section 406.11.

Add new text as follows:

C406.11 Electric Vehicle Supply Equipment. In buildings with at least 20 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least 5 percent of the parking spaces. Fractional values shall be rounded up to the nearest whole number.

Reason: There are now over 1 million electric vehicles being driven in the United States. As of November 2018, over 300,000 light duty vehicles were sold in the United States.

According to a report published by the Edison Electric Institute and the Edison Foundation Institute for Electric Innovation:

- The stock of EVs in the US is projected to reach **18.7 million in 2030**, up from slightly more than 1 million at the end of 2018. This is approximately 7% of the 259 million vehicles (cars and light trucks) expected to be on U.S. roads in 2030.
- It took 8 years to sell 1 million EVs. The report projects that the next 1 million EVs will be on the road in less than 3 years—by early 2021.
- Annual sales of EVs will exceed 3.5 million vehicles in 2030, reaching more than 20 percent of annual vehicle sales in 2030. EV sales are estimated to be 1.4 million in 2025.

Most importantly,

- About 9.6 million charge ports will be required to support the 18.7 million EVs in 2030. This represents a significant investment in EV charging infrastructure. About 1.2 million Level 2 charging ports will be needed at workplaces, according to the report.

This proposal provides an option to install the EV charging station at the lowest cost - when a building is being built.

In addition, Level 2 charging stations are compatible with all electric vehicles that are sold in the US (which have charging connections that meet the SAE J1772 specifications), and they can provide anywhere from 10 to 50 miles of driving range per hour of charging (depending on the size of the EV battery and the on-board charging rate). There are multiple vendors of Level 2 charging stations, and there are state and utility incentives available in many parts of the US for their installation.

This proposal will improve the efficiency of transportation associated with the building (transportation that moves people, products, and services to and from the building). Electric vehicles get anywhere from 80 to over 130 miles per gallon equivalent (MPGe).

Bibliography: EEI and IEI, *Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030*, November 2018
http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20EV%20Forecast%20Report_Nov2018.pdf

Cost Impact: The code change proposal will increase the cost of construction

This is one of several efficiency options that increase the cost of construction. For Level 2 charging stations, the total installation costs per station will vary from \$1000 to over \$2000, depending on the number of stations installed and any addition conduits/raceways/panel spaces that are needed. The cost for these stations are likely to be similar or lower than the cost of other efficiency options in Section C406.

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This does not save energy, this is not the place for this requirement (Vote 11-4).

Assembly Action:

None

CE242-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.11 (New)

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.11 Electric Vehicle Supply Equipment. In buildings with at least ~~20~~ 40 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least ~~5.2~~ 5 percent of the parking spaces. Fractional values shall be rounded up to the nearest whole number.

Energy efficiency credit: Electric Vehicle Supply Equipment shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This proposal is intended simply to provide an alternative (and lower cost) to the "As Submitted" version.

If a parking lot or underground parking garage has 40 or more parking spaces, there will be lighting provided to serve those spaces (and HVAC services if underground). Therefore, there will be panels, conduits, and raceways need to service the garage space, and electric vehicle charging systems would be an incremental cost.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction this proposal would add the cost of a charging station to the cost of constructing certain buildings.

Public Comment# 1587

Public Comment 2:

IECC@: C406.11 (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.11 Electric Vehicle Supply Equipment. In buildings with ~~at least 20~~ 25 to 99 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least ~~5.4~~ 5 percent of the parking spaces. In buildings with 100 to 199 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least 3 percent of the parking spaces. In buildings with at least 200 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2)

shall be installed to serve at least 2 percent of the parking spaces. Fractional values shall be rounded up to the nearest whole number.

Energy efficiency credit: Electric Vehicle Supply Equipment shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This option will save transportation energy, as electric vehicles are much more efficient than vehicles that use gasoline or diesel fuel.

To be consistent with the language of CE 218 and other proposals on energy efficiency credits, this modification assigns a point value for this option. While more EV charging stations at a building will help to save more transportation energy, it was decided to keep the points at a minimum level to ensure that other energy efficiency measures would have to be taken to obtain the necessary number of credits in Section C406.

In addition, the requirements have been modified to lower the cost impact of this option.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Although the proposal will increase the cost of construction, this public comment will reduce the cost increase by reducing the required number of charging stations for larger parking areas.

Public Comment# 1353

Public Comment 3:

Proponents:

Tim Ryan, International Association of Building Officials, representing IABO (t.ryan36421@gmail.com)

requests Disapprove

Commenter's Reason: The International Association of Building Officials is opposed to this proposed change as it goes beyond the scope and intent of the ICC Codes, including the IECC. This provision does not support energy efficiency of buildings but conserves energy while providing convenience to owners of electric vehicles. The primary supporting testimony from proponents of this change was based on the expectation of increased car sales; that certain major cities have adopted similar provisions for their respective jurisdictions; and to address forward thinking. The testimony indicates that these types of requirements tend to be more market driven and are political issues which should be addressed by local and state governance bodies and not by model building codes. Such requirements are more appropriate within land usage and zoning regulations. While the proponents recognize several major jurisdictions that adopted such provisions, it should be recognized that not all jurisdictions agree with such provisions and have considered this issue a private business issue. Therefore, IABO is recommending disapproval of CE242-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1834

CE246-19

IECC@: C407.3

Proposed Change as Submitted

Proponents: Ted Williams, representing American Gas Association (twilliams@aga.org)

2018 International Energy Conservation Code

Revise as follows:

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh – 3413 Btu) rather than energy cost as the metric of comparison. Where energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area is substituted for the energy cost, the source energy multipliers shall be 3.16 for electricity and 1.1 for fuels other than electricity, or other multipliers for national or regional annual average energy consumption from nationally-recognized and validated data sources.

Reason: The proposed change brings C407.3 into greater consistency with R405.3 and source energy metric usage in Federal energy programs including Energy Star for Commercial Buildings and Home Energy Score. This revised exception provides the only means of assessing energy performance on fuel cycle energy consumption and ultimately carbon footprints since site energy metrics alone cannot account for these upstream energy system losses. In addition, the allowance in the proposed exception language for use of "other multipliers" addresses a persistent criticism of national average multipliers, which may not reflect regional or local mixes of renewable energy in meeting building demands, and encourages authorities having jurisdiction to use locally-relevant multipliers that are available from utilities and other sources. Also, greater usefulness of the exception is critical since the basic requirements of C407.3 focusing on energy cost is not consistent with the intent of the IECC as stated in C101.3, which addresses energy use and conservation, not energy cost.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The proposal would not increase the cost of construction since the proposal is for changes to an exception. If the use of source energy metrics allows more alternatives for achieving energy performance improvements, it may decrease construction costs ultimately.

CE246-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: There is consensus the factors are too fluid and need to be tied to a standard and updated regularly, this approach looks backwards not forwards (Vote: 13-2).

Assembly Action:

None

CE246-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C407.3

Proponents:

Ted Williams, American Gas Association, representing American Gas Association (twilliams@aga.org)

Modify as follows:

2018 International Energy Conservation Code

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Where jurisdictions use source energy rather than energy cost as a metric, energy use consumption shall be based upon ~~based on~~ source energy expressed in Btu or Btu per square foot of conditioned floor area and calculated using the source energy multipliers of 2.95 for grid-supplied electricity, 1.09 for natural gas, 1.15 for propane and 1.19 for fuel oil. ~~is substituted for the energy cost, the source energy multipliers shall be 3.16 for electricity and 1.1 for fuels other than electricity, or other multipliers for national, state, or regional, or local annual average energy consumption and published in governmental sources, from nationally recognized and validated data sources,~~

Commenter's Reason: The Committee reasoning that source energy factors are "too fluid" ignores the fact that factors for primary fuels are well-established in literature and building rating tools, and the grid electricity factor of 2.95 has been used in the Pacific Northwest National Laboratory (PNNL) May 2019 report, "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," making use of this factor as federal analytical policy and procedures. While this factor can be changed as an update, to date no documented effort has been extended to challenge use of this factor. "Consensus" in "standards" regarding this factor is a political and market argument among stakeholder, meanwhile the federal government and other authorities are proceeding with using these factors in building rating.

Bibliography: Taylor, T., Mendon, V., Zhan, M., and Liu, B., "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," DOE/EERE, May 2019

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. By allowing use of more reasonable source energy metrics for performance analysis of buildings, greater flexibility in building design would be facilitated and construction cost savings realized.

CE247-19

IECC@: TABLE C407.5.1(1)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Walls, above-grade	Type: same as proposed Mass wall where proposed wall is mass; otherwise steel-framed wall	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed

SWHF = Service water heat recovery factor, DWHR = Drain water heat recovery.

- a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.
- b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.
- c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.
- d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.
- e. The SWHF shall be applied as follows:
 - 1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then $SWHF = [1 - (DWHR \text{ unit efficiency} \cdot 0.36)]$.
 - 2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then $SWHF = [1 - (DWHR \text{ unit efficiency} \cdot 0.33)]$.
 - 3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then $SWHF = [1 - (DWHR \text{ unit efficiency} \cdot 0.26)]$.
 - 4. Where Items 1 through 3 are not met, $SWHF = 1.0$.

Reason: The purpose of this code change proposal is to improve the efficiency of above-grade walls by eliminating an unnecessary loophole. The current standard reference design assumption for above-grade walls is based on mass walls (where mass walls are proposed) or steel-framed walls (regardless of whether steel or wood-framed walls are proposed). The result is that when a building design incorporates wood-framed walls (which are more efficient than steel-framed walls), the building receives a trade-off credit for the difference in efficiency between the steel and wood framing, even though the choice of framing type may have little or nothing to do with efficiency. While we would prefer a single reference design and related budget, if there are to be different standard reference designs for steel versus mass walls, then logically there should be a different design for wood walls as well.

This proposal applies a more consistent approach that will result in improved efficiency. Whether the wall is mass wall, steel-framed, or wood-framed, the baseline will be the insulation requirement for the corresponding wall type set in the prescriptive table. This will eliminate the trade-off loophole and improve efficiency in most climate zones and occupancy types.

Cost Impact: The code change proposal will increase the cost of construction. This proposal will increase the cost of construction for buildings with wood-framed walls because it will either require additional insulation or the incorporation of other energy efficient measures in Section C407 (to be consistent with the current prescriptive path requirements for wood framing). However, we view this as the elimination of an unnecessary loophole that is applying an incorrect baseline in the simulated performance alternative.

CE247-19

Public Hearing Results

Committee Action:

As Submitted

Committee Reason: The performance path is intended to be material neutral (Vote: 12-3).

Individual Consideration Agenda

Public Comment 1:

Proponents:

Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests Disapprove

Commenter's Reason: By setting the standard reference design for frame walls to "as proposed," the proponents of CE247 claim to be eliminating an unnecessary loophole in the performance path of the code. Instead this reveals a fundamental misunderstanding on their part of the structure of the performance path and its role in establishing a minimum standard.

The standard reference design is intended to be the minimum standard; meaning, if you constructed a building to the standard reference design it would comply with the minimum provisions of the code. **The standard reference design is not supposed to be 'above code,'** otherwise 'proposed designs' would be forced to comply with above code provisions.

The above grade frame wall provisions **intentionally** use the steel frame wall assembly as the minimum standard because it is the least stringent assembly with which a builder is required to comply. In other words, steel frame walls establish the minimum standard with which all above grade frame walls must comply. This is the way the performance path was purposely crafted.

CE247 distorts the application of the performance path and requires some buildings with above grade frame walls to perform above minimum code (exactly the opposite of material neutrality). It must be disapproved to protect the integrity of the performance path.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

No change to code. Disapproving CE247 prevents construction costs from rising for applicable building projects since it keeps them from having to comply with 'above code' requirements.

Public Comment# 2106

Public Comment 2:

Proponents:

Loren Ross, representing American Wood Council (lross@awc.org)

requests Disapprove

Commenter's Reason:

CE247 is the opposite of material neutrality.

By changing the reference design to "as proposed" rather than a single reference assembly or U-factor, frame walls would be evaluated to different U-factors from Table C402.1.4. This means wood-frame walls would be required to perform better than steel-frame walls because Table C402.1.4 requires wood-frame walls to meet more stringent U-factors. CE247 therefore takes the inequitable treatment of framing materials embedded in the prescriptive path and extends it to the performance path.

This material bias is in direct conflict with the preface of the IECC that states "*This code is founded on the principles intended to establish ... provisions that do not give preferential treatment to particular types or classes of materials, products, or methods of construction.*"

CE247 must be disapproved to be consistent with the principles of the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No change to code.

CE255-19 Part I

IECC: C202, C503.1

Proposed Change as Submitted

Proponents: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Add new definition as follows:

ROOF MEMBRANE PEEL AND REPLACEMENT. Where an existing roof membrane alone is removed, exposing insulation or sheathing, and only a new weather resisting roof membrane is installed.

Revise as follows:

C503.1 General. *Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.*

Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

Exception: The following *alterations* need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing *fenestration*.
2. Surface-applied window film installed on existing single-pane *fenestration* assemblies reducing solar heat gain, provided that the code does not require the glazing or *fenestration* to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. *Roof recover*.
6. *Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.
7. Roof membrane peel and replacement.

Reason: This new definition and accompanying technical requirement adds a subset of the Roof Recover operation to the International Energy Conservation Code. The operation means that the building owner and manager can re-use the existing insulation providing sustainability to the insulation products in place. The operation provides the building owner and manager with a code approved, economical option that does not increase the energy use of existing buildings, meeting the bolded intent of the 503.1 General Section of the IECC. For convenience, the C503.1 General section is below, bolded for emphasis:

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is **not less conforming to the provisions of this code than the existing building or structure was prior to the alteration.** Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Cost Impact: The code change proposal will decrease the cost of construction

This type of re-roofing operation is where the roof covering membrane is peeled off, and a new roof covering membrane installed over a prepared surface. This operation is not currently allowed by the International Energy Conservation Code. If allowed, Roof Membrane Peel and Replacement will decrease the cost of construction because the operation does not trigger meeting the minimum R-30 c.i. insulation requirements for new construction, as it would today. The operation does not increase the energy usage of the building, consistent with Section C503.1 General's

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: While it addresses a problem that needs to be addressed, there are no criteria which creates conflict with existing language in the IECC and the IBC and creates inspection problems (Vote: 15-0).

Assembly Action:

None

Individual Consideration Agenda

Public Comment 1:

Proponents:

Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Submitted

Commenter's Reason: There is new information since the May Committee Action Hearings. Both the City of Chicago in their adoption of the International Family of Codes and the Illinois Adoption of the 2018 International Energy Conservation Code have this definition and allowance in 503.1.1.

Roof membrane peel and replacement is a way to provide longer service life to the insulation installed on the building's rooftop. Through re-use of the insulation, life cycle costs of the insulation are reduced and landfills saved of massive amounts of insulation.

If the roof membrane peel causes surface irregularities, the roof membrane manufacturer can recommend preparation of the surface which might include a suitable cover board to the assembly that conforms to a listing.

In addition, there are over 900,000 listings in the FM Approval Guide alone, not counting UL's listings. That gives the designer the ability to find another listing, using the existing insulation, cover board, and new membrane, providing code compliance for both wind and fire.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The effect of this code change is that the building owner and manager does not need to buy new insulation for this type or roof operation.

The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings.

The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasibility.

Public Comment# 1781

Public Comment 2:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates life-safety issues for reroofing.

- First, this proposal will have a negative impact on the energy efficiency of existing commercial buildings as it creates an exception for roof replacements from the requirements for new construction (including energy efficiency provisions of the IECC).
- Second, it conflicts with the reroofing requirements in Chapter 15 of the IBC (Section 1511.3 "Roof Replacement"), which requires removal of all existing roof coverings down to the roof deck.
- Third, it creates life safety concerns because "peel and replace" systems are not recognized under third-party listings (such as FM Global or UL). Aspects of performance including wind uplift and fire resistance are evaluated with a "system approach," testing the complete roof assembly rather than individual components. A "peel and replace" membrane would require the same verification to determine whether the new membrane and system meet the building code requirements. This proposal provides zero instruction on how a "peel and replace" project will meet the life and safety requirements of the building code.
- Fourth, this proposal will allow perpetual replacement of the membrane only and it encourages poor roofing practice by not directing the removal of existing materials down to the roof deck to allow for condition assessment of the deck. This further conflicts with the National Roofing Contractors Association's recommendation for existing roof decks to be inspected from both above and below.
- Finally, this proposal is unnecessary since the IBC under Section C1511.3.1 "Roof Recover" permits a one-time roof recover without removal of the membrane to extend the life of the roof system.

Bibliography: Chapter 9 Reroofing, "The NRCA Roofing Manual: Membrane Roof Systems," National Roofing Contractors Association (2019).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1633

CE255-19 Part II

IECC: R202 (N1101.6) , R503.1.1 (IRC N1109.1.1)

Proposed Change as Submitted

Proponents: William McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

ROOF MEMBRANE PEEL AND REPLACEMENT. Where an existing roof membrane alone is removed, exposing insulation or sheathing, and only a new weather resisting roof membrane is installed.

Revise as follows:

R503.1.1 (IRC N1109.1.1) Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof re-cover.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.
7. Roof membrane peel and replacement.

Reason: This new definition and accompanying technical requirement adds a subset of the Roof Recover operation to the International Energy Conservation Code. The operation means that the building owner and manager can re-use the existing insulation providing sustainability to the insulation products in place. The operation provides the building owner and manager with a code approved, economical option that does not increase the energy use of existing buildings, meeting the bolded intent of the 503.1 General Section of the IECC.

For convenience, the C503.1 General section is below, bolded for emphasis:

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is **not less conforming to the provisions of this code than the existing building or structure was prior to the alteration.** Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Cost Impact: The code change proposal will decrease the cost of construction

This type of re-roofing operation is where the roof covering membrane is peeled off, and a new roof covering membrane installed over a prepared surface. This operation is not currently allowed by the International Energy Conservation Code. If allowed, Roof Membrane Peel and Replacement will decrease the cost of construction because the operation does not trigger meeting the minimum R-30 c.i. insulation requirements for new construction, as it would today. The operation does not increase the energy usage of the building, consistent with Section C503.1 General's statements, of the IECC.

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: It creates conflict and the need for flexibility was already captured prior actions. This would decrease energy efficiency. Additionally there are issues with third party systems not covering this and there should have been companion change to the definition of re-roof (Vote: 10-1).

Assembly Action:

None

CE255-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:

Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Submitted

Commenter's Reason: There is new information since the May Committee Action Hearings. Both the City of Chicago in their adoption of the International Family of Codes and the Illinois Adoption of the 2018 International Energy Conservation Code have this definition and allowance in 503.1.1.

Roof membrane peel and replacement is a way to provide longer service life to the insulation installed on the building's rooftop. Through re-use of the insulation, life cycle costs of the insulation are reduced and landfills saved of massive amounts of insulation.

If the roof membrane peel causes surface irregularities, the roof membrane manufacturer can recommend preparation of the surface which might include a suitable cover board to the assembly that conforms to a listing.

In addition, there are over 900,000 listings in the FM Approval Guide alone, not counting UL's listings. That gives the designer the ability to find another listing, using the existing insulation, cover board, and new membrane, providing code compliance for both wind and fire.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The effect of this code change is that the building owner and manager does not need to buy new insulation for this type or roof operation.

The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings.

The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasibility.

Public Comment# 1785

Public Comment 2:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates life-safety issues for reroofing. Roof replacements offer a great opportunity to improve energy efficiency of existing residential buildings. This proposal exempts low-slope roofs from compliance with the energy efficiency requirements for roof replacements by allowing the replacement of the membrane only. The replacement of the membrane alone during the lifetime of the building has critical durability consequences, and incentivizes poor roofing practice by not requiring the removal of existing materials down to the roof deck to allow for condition assessment of the deck. The inspection of the deck is

recognized as a good industry practice, and the National Roofing Contractors Association (see “The NRCA Roofing Manual: Membrane Roof Systems: 2019”) recommends that existing roof decks be inspected from both above and below. In residential low-slope roof applications, wood decks are a common place, and the underside of the roof system may not be accessible. Thus, the removal and inspection of the deck from above may be the only option, and it is a critical aspect of due diligence in roof replacements. Finally, “peel and replace” systems are not recognized under third-party listings (such as FM Global or UL), and thus this raises concerns with how code compliance for wind uplift and fire resistance will be determined.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1629

CE256-19

IECC@: C503.3.1

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., IECC_LLCC representing the National Roofing Contractors Association, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

C503.3.1 Roof replacement. Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

Exception: Where the required R-value cannot be provided due to above-deck thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curbs, low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum approved thickness of insulation compatible with the available space and existing uses shall be installed.

Reason: This proposal is CE287-16 resubmitted with the sole difference clarifying "above-deck" thickness and adding "approved." CE287-16 received a Committee recommendation of "Disapproval," a Public Comment recommendation of "As Modified by Public Comment" (AMPC), but ultimately did not receive the two-thirds necessary to prevail during the "Online Governmental Consensus Vote" (OGCV), leading to "Disapproval" as its Final Action.

Specifically, the newly proposed exception addresses the AMPC and the challenge of constructability when installing additional roof insulation in *reroofing* situations including *roof recover* and *roof replacement* where existing conditions do not allow for the full thickness of insulation required by Table C402.1.3 or Table C402.1.4. Consider the sheer square footage of buildings constructed before an adoption of the 2009 IECC, that now require *reroofing*, without adequate "clear space" to accommodate up to 5+ inches (R-25-ish) or 6+ inches (R-30-ish) of insulation as the IECC evolved thru 2012 to 2015 and now the 2018 Editions. The building stock now considered 10 to 20 to 30+ years old, is far more likely to avail itself of skylight and structural curb heights, scupper and sump depths, door and window access thresholds that would turn into ponds, if five to six inches of insulation were "retroactively" foisted upon building ownership.

Moreover, if the IECC CDC were to consult the premise to Section C505.1, that "... [neither] an increase in demand for either fossil fuel [nor] electrical energy shall comply with this code," so long as the current level of insulation in the roof is replaced with an equivalent thickness/level/R-value of NEW! insulation product, you'd likely conclude that the newly proposed Exception is a "do-no-harm" proposition.

The proposed exception is a pragmatic and constructible solution taken nearly word-for-word from the 2015 IgCC, Section 1003.2.7—Roof Replacement Insulation. We believe the proposal makes clear that the maximum thickness of insulation compatible within the technically-feasible limitations of available space is installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This change better positions the IECC to be clearer, more easily applied to *reroofing*, more competitive than the 90.1 Standard alternative on this issue; thereby no cost impact when compared with current provisions.

CE256-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: This limits projects where scope exceed more than just a roof replacement, it limits code officials ability to require trade off and it doesn't reference and R-value per inch Concern that one threshold could dictate thickness of entire roof. Encourage proponent to develop a public comment to address this and such issues as "existing rooftop conditions, including" (Vote: 11-4).

Assembly Action:

None

CE256-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C503.3.1

Proponents:

Darren Meyers, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C503.3.1 Roof replacement. Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

Exception: Where the required *R-value of insulation entirely above the roof deck* cannot be provided due to above-deck thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curbs, low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum *approved* thickness (*R-value*) of insulation compatible with the available space and existing uses shall be installed. In no case shall the *R-value* of the roof insulation be reduced or the *U-factor* of the roof assembly be increased as part of the *roof replacement*.

Commenter's Reason: The proposal is a pragmatic tool to be utilized solely by the Code Official where the retroactive application of 2021 IECC insulation thicknesses (R-values) are incompatible with existing rooftop conditions.

The proposal is identical to RE217-19 (AM) recommended for "Approval (AM)" by the 2019 IECC Residential Committee. In their reason, the Residential Committee writes: "The proposal provides necessary provisions for builders and code officials to address this situation."

To the 2019 IECC Commercial Committee's concerns:

- 1) The proposal is clearly limited solely to roof replacement operations – NOT any other existing building altering action. To this point, NOTE the "Exception" is located in C503.3.1, entitled "Roof replacement." NOT a trade-off.
- 2) Reference to "trade-offs" is a red herring. The proposal does not limit any authority of the *Code Official*. To the contrary, it empowers the *Code Official* directly to supervise the *approval* of permit applications (as is the case, always). This is by reference to the defined term "*approved*" in the phraseology, "maximum *approved* thickness."
- 3) The Commercial Committee of 15 consisted of two (2) voting consultants to the foam plastics industry. These consultants raised dissenting issues over confusion among "thickness" and "R-value." We are keenly aware that roofing contractors, plastics manufacturers and code enforcement are all capable of deriving "R-value" from "thickness" and "thickness" from "R-value." After all, the manufacturer cut sheets and research submittals specify these product characteristics for the utility of both regulators and installers, alike.
- 4) The proposed language addresses the challenge of constructability when installing additional roof insulation in *roof replacement* situations where existing conditions do not allow for the full thickness of insulation required by Table C402.1.3 or Table C402.1.4. Consider the sheer square footage of buildings constructed before an adoption of the 2009 IECC, that now require *reroofing* without adequate "clear space" to accommodate up to 6+ inches (R-30-ish) of insulation as the IECC evolved from 2012 through the 2018 Editions. The building stock now considered 10 to 20 to 30+ years old, is far more likely to avail itself of skylight and structural curb heights, scupper and sump depths, door and window access thresholds that would turn into ponds, if five to six inches of insulation were "retroactively" foisted upon building ownership.

The proposed exception is a pragmatic and constructible solution taken nearly word-for-word from the 2015 IgCC, Section 1003.2.7—Roof Replacement Insulation. We believe the proposal makes clear that the maximum thickness of insulation compatible within the technically-feasible limitations of available space is installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. For existing roofs, where a *roof replacement* is occurring, application of the current language could be interpreted as requiring an increase (in the thickness/*R-value*) of roof insulation, retroactively. Compliance could become costly, perhaps impossible, for some areas of the existing roof. The proposal offers relief (maintaining current insulation thickness/*R-value* in lieu of adding insulation thickness/*R-value*) in those situations that brings the cost of a roof replacement back in line with the intent of the code for "doing no harm" to an existing structure. This public comment clarifies that intent. Clarifications of the code do not impact costs.

Public Comment# 1704

Public Comment 2:

Proponents:

Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Submitted

Commenter's Reason: The Chicago Roofing Contractors Association (CRCA) was proponent on CE253-19, a similar proposal. We at CRCA believe that the original NRCA proposal is perfect for this application and are withdrawing our CE253-19 in support of CE256-19. As a result, we are withdrawing CE253-19 in support of NRCA's CE256, As Submitted.

There frequently are issues with existing building conditions when it comes to low flashing heights and meeting the requirements for new construction insulation thicknesses. This proposal focuses on the maximum amount of insulation possible given the constraints that are given on an existing building - and does not increase the energy use of the building. In some cases, it reduces energy usage.

The committee commented that there is no R-Value stated in the proposal. Due to economics, no R-Value statement is needed in the proposal. The highest R-Value insulation is already the market share leader, easiest to handle, lightweight, etc. Since most of the cost of installation is in transport and labor, the material cost does not matter as much either. This exception – through the use of the word 'approved' before 'thickness of insulation', - allows the code official to decide if the flashing heights are tall enough to accommodate the new construction insulation thicknesses. The code official has the last word on whether it's technically infeasible or not to install the thickness of insulation required for new construction. This section gives the needed guidance for the code official to make this decision. If it's just a small amount of area that is technically infeasible, the code official can deny the variance.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings.

The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasibility.

Public Comment# 1760

Public Comment 3:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it will reduce building energy efficiency and adds unnecessary language to the code. Roof replacements provide ideal opportunities to improve the energy performance of existing commercial buildings. This proposal adds unnecessary and confusing language to the long-standing requirement that roof replacements shall comply with the thermal envelope requirements for new construction, which can reduce overall building energy use by an average of 5.7%.

- First, the exception is unnecessary because the code already provides authority to the code official where practical difficulties make compliance with the strict letter of the code impractical. A recent survey of Illinois code officials demonstrates that roof replacements do not present unique enforcement challenges as compared to other common building alterations.
- Second, the proposal is overly broad because it contains an open-ended list of common rooftop conditions. Many of these conditions do not create barriers to the installation of additional above deck roof insulation on typical roof replacement projects. Moreover, the open-ended language of "existing rooftop conditions, including [list]" is unenforceable language.
- Third, the proposal incorporates unenforceable language related to the "approved thickness" of insulation. Insulation requirements are written in terms of R-value, not thickness.

We believe unique issues with a particular roof replacement project can be properly and sufficiently addressed under Section C102.1. Therefore, this proposal should be disapproved.

Bibliography: "Existing Commercial Buildings and the Energy Code: An Illinois Enforcement Survey," Midwest Energy Efficiency Alliance (April 2018). Available at: <http://www.mwalliance.org/sites/default/files/meea-research/existing-comm-buildings-enforcement-4.11.18.pdf?current=/taxonomy/term/11>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1634

CE261-19

IECC@: 202 (New), SECTION C505, C505.1, C505.1.1 (New), C505.1.2 (New), C505.2 (New), C505.2.1 (New), C505.2.2 (New), C505.2.3 (New), C505.2.4 (New), TABLE C505.2.2 (New), TABLE C505.2.3 (New), TABLE C505.2.4 (New)

Proposed Change as Submitted

Proponents: David Collins, representing SEHPCAC (sehpcac@iccsafe.org); Maureen Guttman, representing BCAP-IBTS (mguttph@aol.com); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Add new definition as follows:

ENERGY USE INTENSITY (EUI). The metric indicating the total amount of energy consumed by a building in one year divided by the total gross floor area of the building.

SECTION C505 CHANGE OF OCCUPANCY OR USE

C505.1 General. ~~Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.3.2(1) or C405.3.2(2) to another use in Table C405.3.2(1) or C405.3.2(2), the installed lighting wattage shall comply with Section C405.3. Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.4.1, the space is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.~~ from F, H or U occupancy classification shall comply with Section C503. Buildings or portions of buildings undergoing a change of occupancy without alterations shall comply with Section C502.2.

Exceptions Exception:

- ~~1. Where the component performance alternative in Section C402.1.5 is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.~~
2. Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

Add new text as follows:

C505.1.1 Alterations and change of occupancy Alterations made concurrently with any change of occupancy shall be in accordance with Section C503.

C505.1.2 Portions of buildings Where changes in occupancy and use are made to portions of an existing building, only those portions of the building shall comply with Section C505.2.

C505.2 Energy Use Intensities Building envelope, space heating, cooling, ventilation, lighting and service water heating shall comply with Sections C505.2.1 through C505.2.4.

Exceptions:

1. Where it is demonstrated by analysis approved by the code official that the change will not increase energy use intensity.
2. Where the occupancy or use change is less than 5,000 square feet in area.

C505.2.1 Building Envelope Where a change of occupancy or use is made to a whole building that exceeds the maximum fenestration area allowed by Section C402.4.1, the building shall comply with Section C402.1.5, with a proposed UA that shall not be greater than 110 percent of the target UA.

Exception:

Where the change of occupancy or use is made to a portion of the building, the new occupancy is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

C505.2.2 Building Mechanical Systems Where a change of occupancy or use results in the same or increased energy use intensity rank as specified in Table C505.2.2, the systems serving the building or space undergoing the change shall comply with Section C403.

C505.2.3 Service Water Heating Where a change of occupancy or use results in the same or increased energy use intensity rank as specified in Table C505.2.3, the service water heating systems serving the building or space undergoing the change shall comply with Section C404.

C505.2.4 Lighting Where a change of occupancy or use results in the same or increased energy use intensity rank as specified in Table C505.2.4, the lighting systems serving the building or space undergoing the change shall comply with Section C405 except for Sections C405.2.6 and C405.4.

TABLE C505.2.2
Building Mechanical Systems

Energy Use Intensity Rank	International Building Code Occupancy Classification and Use
1. High	A-2, B-Laboratories, I-2
2. Medium	A-1, A-3 ^a , A-4, A-5, B ^b , E, I-1, I-3, I-4, M, R-4
3. Low	A-3-Places of Religious Worship, R-1, R-2, R-3 ^c , S-1, S-2

a. Excluding places of religious worship.

b. Excluding laboratories.

c. Buildings three stories or less in height above grade plane shall comply with Section R505.

TABLE C505.2.3
Service Water Heating

Energy Use Intensity Rank	International Building Code Occupancy Classification and Use
1. High	A-2, I-1, I-2, R-1
2. Low	All other occupancies and uses

TABLE C505.2.4
Lighting

Energy Use Intensity Rank	International Building Code Occupancy Classification and Use
1. High	B-Laboratories, B-Outpatient Healthcare, I-2, M
2. Medium	A-2, A-3 Courtrooms, B ^a , I-1, I-3, I-4, R-1, R-2, R-3 ^b , R-4, S-1, S-2
3. Low	A-1, A-3 ^c , A-4, E

a. Excluding laboratories and outpatient healthcare.

b. Buildings three stories or less in height above grade plane shall comply with Section R505.

c. Excluding courtrooms.

Reason: The IECC 2018 change of occupancy requirement (C505.1) begins with this statement:

“Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.”

Field research and surveys of building officials demonstrate that this requirement is difficult to enforce (Clinton et al, 2016). One reason for this is that while it is a clear performance requirement, there is no simple compliance evaluation method other than energy modeling, which is beyond the capabilities of most change-of-occupancy permit applicants. As depicted in the referenced survey findings and community-based pilot research, building officials often require energy efficiency equipment upgrades, such as lighting or HVAC, in buildings undergoing a change of occupancy. This proposal seeks to provide clarity to that approach by providing a simple breakdown of energy use intensity (EUI) by building occupancy type and system type.

The proposed code change draws on a tradition of rehabilitation “smart codes” use-based lookup tables, is more consistent with the intent of the IECC, presents no cost increase, and incorporates extensive research and stakeholder input.

This proposal advances the Energy Use Intensity (EUI) as the metric for energy demand and the trigger for code compliance. Historic energy intensity per square foot is recorded for commercial buildings in the *Commercial Buildings Energy Consumption Survey* (CBECS). The CBECS data make it possible to rank building occupancies in the order of the energy intensities. Note that the ranking of occupancies to trigger specific code requirements has been a feature of the *International Existing Building Code* (IEBC) since its earliest editions (see IEBC 2009 Section 912, Change of Occupancy Classification, Tables 912.4, 912.5 and 912.6), and thus is familiar to building code officials.

Energy intensity data in CBECS is further broken down by various end uses (space conditioning, service water heating and lighting) which makes it possible to identify when it is appropriate to trigger code compliance of specific sections of the IECC. For each of these end uses, an increase in intensity triggers compliance with the correlating code provisions related to new construction in Chapter 4. Only an increase in energy intensities in all three of the end uses triggers full compliance with the code.

There are two exceptions that apply to all four end uses, indicated in Section C505.2:

1. Where it is demonstrated by analysis approved by the code official that the change will not increase energy use intensity.
2. Where the occupancy or use change is less than 5,000 square feet in area.

A matrix has been developed for each system end use that groups building occupancy classifications into HIGH, MEDIUM and LOW energy use intensities, measured in annual kBtu/sf. Data for this analysis came from the U.S. Department of Energy’s 2012 CBECS. When occupancy classification or use is being changed from one energy intensity rank to a higher energy use intensity rank (or remains within the same energy use intensity rank), this proposal requires that specific system end-use to comply with the code.

Change of Occupancy Scale - Space Heating, Cooling and Ventilation

EUI Rank	CBECS Building Type	EUI Range kBtu/sq.ft.	IBC Occupancy Classification
1. High	Food Service, Laboratories, Health Care (Inpatient)	> 55	A-2, B-Laboratories, I-2
2. Medium	Public Assembly, Public Order and Safety, Office, Service, Health Care (Outpatient), Education, Retail, Residential Care/Assisted Living	27 - 55	A-1, A-3, A-4, A-5, B, E, I-1, I-3, I-4, M, R-4
3. Low	Religious Worship, Apartments, Warehouse and Storage	<27	A-3 Places of Worship, R-1, R-2, R-3, S-1, S-2

Change of Occupancy Scale - Service Water Heating

EUI Rank	CBECS Building Type	EUI Range kBTU/sq.ft.	IBC Occupancy Classification
1. High	Food Service, Health Care (Inpatient), Residential Care/Assisted Living, Lodging	> 15	A-2, I-1, I-2, R-1
2. Low	All the rest	< 15	All the rest

Change of Occupancy Scale- Lighting

EUI Rank	CBECS Building Type	EUI Range kBTU/sq.ft.	IBC Occupancy Classification
1. High	Laboratories, Health Care (Outpatient), Health Care (Inpatient), Retail	> 11	B-Laboratories, B-Healthcare (Outpatient), I-2, M
2. Medium	Food Service, Office, Health Care (Outpatient), Service, Public Order and Safety, Residential Care/Assisted Living, Lodging, Apartments, Warehouse and Storage	6.5 - 11	A-2, A-3-Courtrooms, B, I-1, I-3, I-4, R-1, R-2, R-3, R-4, S-1, S-2
3. Low	Public Assembly, Religious Worship, Education	< 6.5	A-1, A-3, A-4, E

Occupancy classifications F, H and U are typically not designed primarily for occupant comfort, and are generally classified as low energy use intensity buildings. Thus any change from one of these groups to any other should be required to comply with the provisions under Section C503 Alterations, even if no physical alteration is planned.

Section C505.2.1 Building Envelope is included as a building system, although with different criteria than EUI Intensity. The requirement and exception exist in the 2018 language; they are simply relocated in this proposal.

This code change proposal has been developed with support from the Consortium for Building Energy Innovation (CBEI), a project of the U. S. Department of Energy, and research conducted by Rutgers University Center for Green Building.

Bibliography: Clinton J. Andrews, David Hattis, David Listokin, Jennifer A. Senick, Gabriel B. Sherman & Jennifer Souder (2016): Energy –Efficient Reuse of Existing Commercial Buildings, *Journal of the American Planning Association*. doi.10.1080/01944363.2015.1134275

Cost Impact: The code change proposal will not increase or decrease the cost of construction. The current code requirements trigger full compliance with the code when there is an increase in energy demand. The proposed code change offers the metric of energy use intensity per square foot per year for measuring energy demand by occupancy. It applies this metric separately to three energy end uses: space conditioning, lighting, and water heating. Therefore, compliance with the code is triggered only for the end uses for which energy intensity is increased.

In most cases, the proposed change triggers partial code compliance, and only rarely will it trigger full code compliance.

CE261-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The introduction of EUI is very helpful, but clarification is needed in C505.1 for referenced sections. Proponent encouraged to return with a public comment (Vote: 9-6).

Assembly Action:

None

CE261-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Maureen Guttman, Building Codes Assistance Project, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION C505 CHANGE OF OCCUPANCY OR USE

C505.1 General. ~~Spaces~~ Buildings or portions of buildings undergoing a change in occupancy from F, H or U occupancy classification to an occupancy classification other than F, H or U shall comply with Section C503. ~~Other B~~ Buildings or portions of buildings undergoing a change of occupancy without alterations shall comply with Section ~~C502.2~~ C505.2.

Exception: Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

Commenter's Reason: The original code change proposal contained a typographical error that was pointed out by the committee members. The second sentence of Section C505.1 referred to Section C502.2 but should have referred to Section C505.2. The committee elected not to make this minor modification as the proponents could not immediately confirm that the Section number was incorrect.

Committee members also noted an inconsistency between the first and second sentences of Section C505.1. The first sentence refers to "spaces undergoing a change in occupancy..." while the second sentence refers to "buildings or portions of buildings undergoing a change or occupancy...." This modification corrects the language of the first sentence to match the intent of scoping indicated by the second sentence.

A building or portion of building undergoing a change of occupancy from F, H or U to an occupancy other than F, H or U - even without alterations being planned - will realize an increase in EUI according to CBECS data and must therefore be considered an alteration. Such a change in occupancy must comply with Section C503 Alterations.

A building or portion of building other than F, H or U occupancies changing to another occupancy where there are no alterations planned shall comply with Section C505.2, which recognizes that such a change of occupancy may not increase the building's EUI, or may only increase the EUI of individual building systems.

The objective of this code change proposal as amended is to encourage limited but reasonable energy improvements for existing buildings where no other alteration work is planned during a change in occupancy or use. In contrast to the code's existing language, this change will decrease the cost of construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The current code requirements trigger full compliance with the code when there is an increase in energy demand. The proposed code change offers the metric of energy use intensity per square foot per year for measuring energy demand by occupancy. It applies this metric separately to three energy end uses: space conditioning, lighting, and water heating. Therefore, compliance with the code is triggered only for the end uses for which energy intensity is increased.

In most cases, the proposed change triggers partial code compliance, and only rarely will it trigger full code compliance.

Public Comment# 1968

CE262-19

IECC@: CA103.6, CA103.7 (New), CA103.8

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

CA103.6 Interconnection pathway. Construction documents shall indicate pathways for routing of conduit or piping from the solar-ready zone to the electrical service panel and electrical energy storage system area, or service hot water system.

Add new text as follows:

CA103.7 Electrical energy storage system-ready area. The floor area of the electrical energy storage system-ready area shall be not less than 2 feet in one dimension and 4 feet in another dimension, and located in accordance with Section 1206.2.8 of the *International Fire Code*. The location and layout diagram of the electrical energy storage system-ready area shall be indicated on the construction documents.

Revise as follows:

~~CA103.7~~ **CA103.8 Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric installation and a dual-pole circuit breaker for future electrical energy storage system installation. These spaces shall be labeled "For Future Solar Electric and Storage." The reserved space spaces shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

Reason: Appendix CA in IECC-commercial and Appendix RB in IECC-residential have proven useful for jurisdictions seeking to add solar ready provisions to state or local codes. As many jurisdictions in which the appendices are being considered are also facing current or future constraints on electric grid capacity to accommodate existing and new distributed solar generation resources, policy objectives are emerging to support the storage of energy produced by solar panels and shift its temporal impact on the grid.

This proposal modifies Appendix CA provisions to ensure that there is design and space consideration for a standard sized battery rack, and for the connections to the electrical panels. As with the rationale for solar-ready, it is generally much more cost-effective at the time of new construction to design for future installation of this equipment than it is to retrofit later in the building's life.

The proposed language also cites the IFC to ensure there is sufficient clearance around the battery rack to meet life/safety concerns. The IFC is already referenced in Chapter 6.

Cost Impact: The code change proposal will increase the cost of construction

The cost impacts are limited to additional design professional fees, to markings on the panels, and to additional construction costs only if there were not spare square footage available in the equipment or storage rooms where panels are generally located. In that case, it would be equal to the construction costs for an additional 8 square feet of storage space.

CE262-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The proposal needs to coordinate better with the IFC (Vote: 15-0).

Assembly Action:

None

CE262-19

Individual Consideration Agenda

Public Comment 1:

IECC@: CA103.6, CA103.7 (New), CA103.8

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

CA103.6 Interconnection pathway. Construction documents shall indicate pathways for routing of ~~conduit or piping~~ raceways or cable from the solar-ready zone to the electrical service panel and electrical energy storage system area, or service hot water system.

CA103.7 Electrical energy storage system-ready area. The floor area of the electrical energy storage system-ready area shall be not less than 2 feet in one dimension and 4 feet in another dimension, and located in accordance with Section 1206.2.8 of the *International Fire Code* and Section 110.26 of the NFPA 70. The location and layout diagram of the electrical energy storage system-ready area shall be indicated on the construction documents.

CA103.8 Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric and a ~~dual-pole~~ two-pole circuit breaker for future electrical energy storage system installation. These spaces shall be labeled "For Future Solar Electric and Storage." The reserved spaces shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

Commenter's Reason: Disapproval was requested for CE262 at the Code Action Hearings in order to modify and clarify the language to ensure that the solar storage ready requirement would correlate with the International Fire Code and National Electric Code. Also, some of the terminology was changed in the proposal to bring it into alignment with common terminology used in the industry.

Appendix CA in IECC-commercial and Appendix RB in IECC-residential have proven useful for jurisdictions seeking to add solar ready provisions to state or local codes. As many jurisdictions in which the appendices are being considered are also facing current or future constraints on electric grid capacity to accommodate existing and new distributed solar generation resources, policy objectives are emerging to support the storage of energy produced by solar panels and shift its temporal impact on the grid. This proposal modifies Appendix CA provisions to ensure that there is design and space consideration for a standard sized battery rack, and for the connections to the electrical panels. As with the rationale for solar ready, it is generally much more cost-effective at the time of new construction to design for future installation of this equipment than it is to retrofit later in the building's life.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. The cost impacts are limited to additional design professional fees, to markings on the panels, and to additional construction costs only if there were not spare square footage available in the equipment or storage rooms where panels are generally located. In that case, it would be equal to the construction costs for an additional 8 square feet of storage space.

Public Comment# 1911

CE263-19 Part I

IECC: Appendix CB (New)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY IECC-CE COMMITTEE. PARTS II and III WILL BE HEARD BY THE IECC-RE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Add new text as follows:

Appendix CB SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED - COMMERCIAL

SECTION CB101 SCOPE

CB101.1 General. These provisions shall be applicable for newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, where solar photovoltaic (PV) systems are required.

SECTION CB102 DEFINITIONS

Revise as follows:

CB102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

Add new text as follows:

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules.

SECTION CB103 SOLAR PHOTOVOLTAIC (PV) SYSTEMS

CB103.1 Renewable energy systems. Newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, shall have an on-site solar photovoltaic system installed. Photovoltaic (PV) systems shall comply with Sections CB103.2 through CB103.4. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1. Where the code official determines the building has satisfied the purpose and intent of this provision through the use of alternative on-site renewable energy systems such as wind energy systems.
2. Where the code official determines an on-site or off-site community solar facility is dedicated to the building with a legally binding and executed agreement, in conformance with Section CB103.3.

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.

CB103.3. Community solar facility Where a community solar facility is used as an alternative to an on-site photovoltaic system, the community solar facility shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the community solar facility in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The community solar facility shall provide the required energy savings benefits to the dedicated building for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

CB103.4 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

Reason: Part I

This proposal provides a new Appendix chapter for the commercial portion of the IECC, which would be available to jurisdictions wanting to adopt renewable energy requirements for new commercial buildings and additions greater than 5,000 square feet. This proposal continues to move renewable energy into mainstream practice for the design and construction industries, which helps to decrease demand on utilities. The benefit to the building owner or tenant is lower utility bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

The Washington State Building Code Council voted to include this language as Appendix D in the Washington State Energy Code. This requirement has been in the main body of the Seattle Energy Code since 2012, and is included as Section C411.

Language has been added to ensure the requirements of the Appendix do not conflict with Section C406. If the on-site renewable energy option in Section C406 is selected, both requirements are cumulative.

Part II

This proposal provides a new Appendix for the residential portion of the IECC which would be available to jurisdictions wanting to adopt renewable energy requirements for new residential buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal continues to move renewable energy into mainstream practice for the design and construction industries which will diversify the state and jurisdictional energy portfolio amongst traditional energy resources and new renewable generation via utilities and distributed energy resources. The benefit to the homeowner is lower, more consistent energy bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

This proposal is modeled after the California Energy Commission (CEC) model ordinance language, which is useful to early adopters that want to require PV for new residential buildings in their communities, with a modification to allow jurisdictions flexibility to further customize.

Individual technical provisions of this appendix are also based on 2019 CA Building Energy Efficiency Standards (BEES):

Joint Appendix JA11 -- Qualification Requirements for Photovoltaic System, and

Section 10-115 -- Community Shared Solar Electric Generation System or Community Shared Battery Storage System Compliance Option for Onsite Solar Electric Generation or Battery Storage Requirements.

Part III

This proposal provides a new Appendix for the International Residential Code which would be available to jurisdictions wanting to adopt renewable energy requirements for new one- and two family dwellings and townhouse buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal is written to parallel the appendix proposed for the IECC-Residential code provisions found in Part II of this proposal. Please consider the reason statement provided for Part II.

Bibliography: 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (See Section 10-115 for Community Solar) **2019 Reference Appendices for Residential and Nonresidential Buildings** (See Joint Appendix JA11 for Qualification Requirements for PV)

Rooftop solar PV system report for the 2019 [California Energy] Standards update.

Report prepared by Energy and Environmental Economics, Inc. under contract with the California Energy Commission.

<https://efiling.energy.ca.gov/getdocument.aspx?tn=221366>

Q3/Q4 2018 Solar Industry Update - January 2019

David Felman, Anna Ebers, and Robert Margolis. Q3/Q4 2018 Solar Industry Update - January 2019

<https://www.nrel.gov/docs/fy19osti/73234.pdf>

U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

Ran Fu, David Feldman, Mike Woodhouse, and Robert Margolis. 2018 U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

<https://www.nrel.gov/docs/fy19osti/72399.pdf>

Study Summary: <https://www.nrel.gov/news/program/2018/costs-continue-to-decline-for-residential-and-commercial-photovoltaics-in-2018.html>

Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. 2018. Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20- 71652.

<https://www.nrel.gov/docs/fy19osti/71652.pdf>

Cost Impact: The code change proposal will increase the cost of construction. When adopted, this appendix chapter will increase the first cost of commercial building construction, but will reduce overall operating cost, provide for more consistent energy bills and save money on monthly energy bills.

A report completed by NREL shows the current cost benchmark of \$1.83 per Wdc for commercial systems, which is a decrease from the previous quarter. If you multiply \$1.83 per Watt times 0.25 Watts rated peak photovoltaic energy production per square foot of floor area, then the conservative resulting installation cost would be approximately \$458 per 1,000 square feet based on this proposal. In 2021, the federal rebate for photovoltaic systems steps down to 22 percent. There may also be state and local rebates or other subsidies helping to reduce up-front costs.

If PV systems are financed by third parties through a lease or PPA, the first cost of the building might not be impacted, and building occupants will experience immediate savings on energy bills.

Greater cost savings can be realized by installing PV systems on new buildings at the first construction outset due to ease of permitting, more efficient inspections, the ability to integrate solar installations with the regular building schedule and the efficiencies of repetitive procedures.

CE263-19 Part I

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

Disapproved

Committee Reason: The original proposal appears to trade off renewables for efficiency in C407, there is a lot of work to do - encourage the proponent to develop a shelf ready proposal, addressing size of buildings, alternative compliance options (Vote: 13-2).

Assembly Action:

None

CE263-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC@: Appendix CB (New), SECTION CB101 (New), CB101.1 (New), SECTION CB102 (New), CB102.1 (New), (New), SECTION CB103 (New), CB103.1 (New), CB103.2 (New), CB103.2.1 (New), CB103.2.2 (New), CB103.3. (New), CB103.4 (New)

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

Appendix CB SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED - COMMERCIAL

SECTION CB101 SCOPE

CB101.1 General. These provisions shall be applicable for newly constructed commercial buildings, or additions larger than ~~5,000~~ 10,000 square feet of gross conditioned floor area to commercial buildings, where solar photovoltaic (PV) systems are required.

SECTION CB102 DEFINITIONS

CB102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system and allocates bill credits to customers, ~~and is qualified as a community energy facility, and allocates bill credits to customers~~ under state and local utility statutes and rules.

SECTION CB103 SOLAR PHOTOVOLTAIC (PV) SYSTEMS

CB103.1 Renewable energy systems. Newly constructed commercial buildings, or additions larger than ~~5,000~~ 10,000 square feet of gross conditioned floor area to commercial buildings, shall have an on-site solar photovoltaic system installed. Photovoltaic (PV) systems shall comply with Sections ~~CB103.2 through CB103.4~~. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1. Where the code official determines the building has satisfied the purpose and intent of this provision through the use of alternative on-site renewable energy systems ~~such as wind energy systems~~.
2. Where the code official ~~determines~~ approves an on-site or off-site community solar facility ~~is~~ dedicated to the building with a legally binding and executed agreement, in conformance with Section CB103.3.

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. ~~Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.~~

CB103.2.1 Additional efficiency package options. The PV capacity required in this section shall not be used for compliance with the onsite renewable energy option of Section C406.5.

CB103.2.2 Total building performance. Where the total building performance of Section C407 is used for compliance, the PV capacity required in this section shall be the same in the *standard reference design* and the *proposed design*.

CB103.3. Community solar facility Where a community solar facility is used as an alternative to an on-site photovoltaic system, the community solar facility shall provide energy ~~savings~~ benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy ~~savings~~ benefits shall be allocated from the total resource of the community solar facility in a manner demonstrated to be equivalent to the ~~reductions in energy consumption~~ generation of energy that would have resulted from the on-site photovoltaic system that is otherwise required. The community solar facility shall provide the required energy ~~savings~~ benefits to the dedicated building for a period not less than twenty years. The energy ~~savings~~ benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

CB103.4 Leases and power purchase agreements. ~~On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.~~

Commenter's Reason: This proposal provides a new Appendix chapter for the commercial portion of the IECC, which would be available to jurisdictions wanting to adopt renewable energy requirements for new commercial buildings and additions greater than 5,000 square feet. This proposal continues to move renewable energy into mainstream practice for the design and construction industries, which helps to decrease demand on utilities. The benefit to the building owner or tenant is lower utility bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

The Washington State Building Code Council voted to include this language as Appendix D in the Washington State Energy Code. This requirement has been in the main body of the Seattle Energy Code since 2012, and is included as Section C411.

Language has been added to ensure the requirements of the Appendix do not conflict with Section C406. If the on-site renewable energy option in Section C406 is selected, both requirements are cumulative.

FOR THIS PUBLIC COMMENT:

The definition of Community Solar is revised as an editorial change only.

CB103.1 is revised in response to stakeholder input:

- to revise the threshold for building size to be consistent with ASHRAE
- to clarify that charging language is included in CB103.2
- to clarify that Items 1 and 2 are conditions, rather than exceptions
- other editorial changes as suggested by stakeholder input

CB103.2 is revised in response to stakeholder input:

- to clarify the language regarding Sections C406.5 and C407, to preclude the possibility of double-counting renewable energy systems required to be installed when this appendix chapter is adopted.

CB103.3 is revised in response to stakeholder input:

- editorial changes consistent with Modification CAIN-1

CB103.4 is removed in response to committee discussion, with a IECC-Residential committee member pointing out that ownership of a PV system is not relevant to IECC requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

When adopted, this appendix chapter will increase the first cost of commercial building construction, but will reduce overall operating cost, provide for more consistent energy bills and save money on monthly energy bills.

A report completed by NREL shows the current cost benchmark of \$1.83 per Wdc for commercial systems, which is a decrease from the previous quarter. If you multiply \$1.83 per Watt times 0.25 Watts rated peak photovoltaic energy production per square foot of floor area, then the conservative resulting installation cost would be approximately \$458 per 1,000 square feet based on this proposal. In 2021, the federal rebate for photovoltaic systems steps down to 22 percent. There may also be state and local rebates or other subsidies helping to reduce up-front costs.

If PV systems are financed by third parties through a lease or PPA, the first cost of the building might not be impacted, and building occupants will experience immediate savings on energy bills.

Greater cost savings can be realized by installing PV systems on new buildings at the first construction outset due to ease of permitting, more efficient inspections, the ability to integrate solar installations with the regular building schedule and the efficiencies of repetitive procedures.

Public Comment# 1869

Public Comment 2:

IECC@: CB103.2 (New)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406. Where the total building performance of Section C407 is used for compliance, the PV system capacity required in this section shall be the same in the standard reference design and the proposed design.

Commenter's Reason: This public comment is provided in the event that CE263-19-Part 1 is considered for approval at the public hearing. As proposed, CE263 should be disapproved for the reasons given by the committee and testimony at the committee action hearing. However, there is one significant concern that is addressed by this public comment. It is related to clarifying that mandated PV capacity should not be used as a basis for making trade-offs that decrease the building performance and thus negate the benefits of adding the mandated PV to a building (the same should also apply to voluntary use of renewable energy generation for the same reason). Renewable energy is not free and is not an unlimited resource. The ability to use it to minimize non-renewable energy use requires that energy conservation not be sacrificed. This public comment is aimed specifically at that concern.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. It is not clear that the public comment would add any additional cost to the original proposal's cost increase. It will, however, prevent mandated PV (if adopted) from being subsidized by weakening the building's energy conservation measures through trade-offs in the performance path. Consequently, this PC will tend to decrease cost of building operation and maximize the benefits of PV.

Public Comment# 1762

Public Comment 3:

IECC@: Appendix CB (New), SECTION CB101 (New), CB101.1 (New), SECTION CB102 (New), CB102.1 (New), (New), SECTION CB103 (New), CB103.1 (New), CB103.2 (New), CB103.2.1 (New), CB103.2.2 (New), CB103.3. (New), CB103.4 (New)

Proponents:

Maureen Guttman, Building Codes Assistance Project, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

Appendix CB SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED - COMMERCIAL

SECTION CB101 SCOPE

CB101.1 General. These provisions shall be applicable for newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, where solar photovoltaic (PV) systems are required.

SECTION CB102 DEFINITIONS

CB102.1 General: The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions:

COMMUNITY SOLAR FACILITY: A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules.

SECTION CB103 SOLAR PHOTOVOLTAIC (PV) SYSTEMS

CB103.1 Renewable energy systems. Newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, shall have an on-site solar photovoltaic system installed. Photovoltaic (PV) systems shall comply with Sections

CB103.2 through CB103.4. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1. Where the code official determines the building has satisfied the purpose and intent of this provision through the use of alternative on-site renewable energy systems ~~such as wind energy systems~~.
2. Where the code official ~~approves~~ determines an on-site or off-site community solar facility ~~is~~ dedicated to the building with a legally binding and executed agreement, in conformance with Section CB103.3.
3. Where the code official approves a lease or power purchase agreement in conformance with Section CB103.4.

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. ~~Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.~~

CB103.2.1 On-site renewable energy option. Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.

CB103.2.2 Total building performance option. Where the total building performance option in Section C407 is selected, the minimum installed capacity required in this section shall be in addition to the five percent minimum allowed in Section C407.

CB103.3. Community solar facility Where a community solar facility is used as an alternative to an on-site photovoltaic system, the community solar facility shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the community solar facility in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The community solar facility shall provide the required energy savings benefits to the dedicated building for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

CB103.4 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

Commenter's Reason: The proposal to require solar energy on commercial buildings is appropriately positioned as an appendix, allowing a jurisdiction to incorporate this requirement as part of their adopted energy code.

The definition for Community Solar Facility is not required, as the provision of Section CB103.1(2) clearly indicates that the code official must approve such a facility for it to be acceptable as an alternative to a system installed on the building. Additionally, the phrase "...is qualified as a community energy facility..." adds confusion since there is no indication as to who provides such qualification.

The second sentence of Section CB 103.1 is modified to clarify that photovoltaic systems shall comply with Section CB103.2 only. Subsection CB103.1(3) is added to provide reference to Subsection CB103.4. Subsections CB103.3 and CB103.4 are alternatives to the requirements of Section CB103.2 only where approved by the code official.

The last sentence of Section CB103.2 should be a subsection, as it will not apply to every project subject to the provisions of CB103.2.

Subsection CB103.2.2 is added to ensure that even where solar energy systems are required by the AHJ, the renewable energy generated cannot be used to offset the required energy efficiency of Chapter 4 beyond the minimum allowed in Section C407.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This public comment only provides clarification for the original proposal. Therefore, the net effect of both has the same impact on construction costs.

CE263-19 Part II

IECC: Appendix RB (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Add new text as follows:

Appendix RB SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED

SECTION RB101 SCOPE

RB101.1 General. These provisions shall be applicable for newly constructed residential buildings where solar photovoltaic (PV) systems are required.

SECTION RB102 DEFINITIONS

RB102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

Add new definition as follows:

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers, under state and local utility statutes and rules.

STEEP SLOPE. A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

Add new text as follows:

SECTION RB103 SOLAR PHOTOVOLTAIC SYSTEM

RB103.1 Renewable energy systems. Newly constructed residential buildings shall have an on-site solar photovoltaic (PV) system installed. Photovoltaic systems shall comply with Sections RB103.2 through RB103.6. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1. Where the code official determines there are practical challenges that cause satisfaction of the requirements to be infeasible. Practical challenges include, but are not limited to, building site location, limited rooftop availability, or shading from nearby structures, topography, or vegetation.
2. Where the code official determines the purpose and intent of this provision is satisfied through the use of alternative on-site renewable energy systems such as wind energy systems.
3. If the code official determines an on-site or off-site community solar facility is dedicated to the building with a legally binding and executed agreement, and is in conformance with Section RB103.5.

RB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section RB103.2.1 or performance PV sizing in Section RB103.2.2. Buildings with conditioned floor area of 4,500 square feet or greater shall use the performance PV sizing approach in Section RB103.2.2.

RB103.2.1 Prescriptive PV sizing method. For the prescriptive PV sizing method, the PV system installed nameplate capacity (kW_{DC}) shall be not less than 1.0 times the conditioned floor area (1.0 Watts per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}).

RB103.2.2 Performance PV sizing method. For the performance PV sizing method, the PV system shall be sized to meet at least 75 percent of the building's total electrical energy use on an annual basis, including both conditioned and unconditioned space. The minimum PV system size requirement (kW_{DC}) shall be calculated using modeling software or other methods approved by the code official.

RB103.3 Photovoltaic system orientation. Fixed-orientation photovoltaic systems located on steep sloped roofs shall be oriented with azimuth of each array between 90 degrees and 300 degrees measured clockwise from true north.

Exception: Photovoltaic systems with one or more arrays oriented outside the prescribed azimuth range when the PV system is modeled using performance PV sizing method in Section RB103.2.2..

RB103.4 Shading. All PV systems shall be designed to meet minimal shading criterion in Section RB103.4.1 or the detailed geometries of PV arrays and obstructions shall be considered in the performance PV sizing method in conformance with Section RB103.4.2.

RB103.4.1 Minimal shading criterion. To comply with minimal shading criterion, a PV array shall be no closer to any shading obstruction than twice the height of the obstruction above the PV array. All obstructions that project above the point on the PV array that is closest to the obstruction shall meet this criterion for the array to be considered minimally shaded.

Exception: Any obstruction located north of all points on the array need not be considered as a shading obstruction...

RB103.4.2 Solar access verification. Where any PV array does not meet the minimal shading criterion of Section RB103.4.1, detailed geometries of the PV array and shading profiles from obstructions shall be considered in the performance PV sizing method. Shading profiles shall be measured with a solar assessment tool or determined from aerial satellite images or other automated resources approved by the code official.

RB103.5 Community solar facility. Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community solar facility* shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy savings benefits to the dedicated *building* for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

SECTION RB104 LEASES AND PURCHASE AGREEMENTS

RB104.1 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

Reason: Part I

This proposal provides a new Appendix chapter for the commercial portion of the IECC, which would be available to jurisdictions wanting to adopt renewable energy requirements for new commercial buildings and additions greater than 5,000 square feet. This proposal continues to move renewable energy into mainstream practice for the design and construction industries, which helps to decrease demand on utilities. The benefit to the building owner or tenant is lower utility bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

The Washington State Building Code Council voted to include this language as Appendix D in the Washington State Energy Code. This requirement has been in the main body of the Seattle Energy Code since 2012, and is included as Section C411.

Language has been added to ensure the requirements of the Appendix do not conflict with Section C406. If the on-site renewable energy option in Section C406 is selected, both requirements are cumulative.

Part II

This proposal provides a new Appendix for the residential portion of the IECC which would be available to jurisdictions wanting to adopt renewable energy requirements for new residential buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal continues to move renewable energy into mainstream practice for the design and construction industries which will diversify the state and jurisdictional energy portfolio amongst traditional energy resources and new renewable generation via utilities and distributed energy resources. The benefit to the homeowner is lower, more consistent energy bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

This proposal is modeled after the California Energy Commission (CEC) model ordinance language, which is useful to early adopters that want to require PV for new residential buildings in their communities, with a modification to allow jurisdictions flexibility to further customize.

Individual technical provisions of this appendix are also based on 2019 CA Building Energy Efficiency Standards (BEES):

Joint Appendix JA11 -- Qualification Requirements for Photovoltaic System, and

Section 10-115 -- Community Shared Solar Electric Generation System or Community Shared Battery Storage System Compliance Option for Onsite Solar Electric Generation or Battery Storage Requirements.

Part III

This proposal provides a new Appendix for the International Residential Code which would be available to jurisdictions wanting to adopt renewable

energy requirements for new one- and two family dwellings and townhouse buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal is written to parallel the appendix proposed for the IECC-Residential code provisions found in Part II of this proposal. Please consider the reason statement provided for Part II.

Bibliography: 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (See Section 10-115 for Community Solar) 2019 Reference Appendices for Residential and Nonresidential Buildings (See Joint Appendix JA11 for Qualification Requirements for PV)

Rooftop solar PV system report for the 2019 [California Energy] Standards update.

Report prepared by Energy and Environmental Economics, Inc. under contract with the California Energy Commission.

<https://efiling.energy.ca.gov/getdocument.aspx?tn=221366>

Q3/Q4 2018 Solar Industry Update - January 2019

David Felman, Anna Ebers, and Robert Margolis. Q3/Q4 2018 Solar Industry Update - January 2019

<https://www.nrel.gov/docs/fy19osti/73234.pdf>

U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

Ran Fu, David Feldman, Mike Woodhouse, and Robert Margolis. 2018 U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

<https://www.nrel.gov/docs/fy19osti/72399.pdf>

Study Summary: <https://www.nrel.gov/news/program/2018/costs-continue-to-decline-for-residential-and-commercial-photovoltaics-in-2018.html>

Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. 2018. Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20- 71652.

<https://www.nrel.gov/docs/fy19osti/71652.pdf>

Cost Impact: The code change proposal will increase the cost of construction

When adopted, this appendix chapter will increase the first cost of commercial building construction, but will reduce overall operating cost, provide for more consistent energy bills and save money on monthly energy bills.

A report completed by NREL shows the current cost benchmark of \$1.83 per Wdc for commercial systems, which is a decrease from the previous quarter. If you multiply \$1.83 per Watt times 0.25 Watts rated peak photovoltaic energy production per square foot of floor area, then the conservative resulting installation cost would be approximately \$458 per 1,000 square feet based on this proposal. In 2021, the federal rebate for photovoltaic systems steps down to 22 percent. There may also be state and local rebates or other subsidies helping to reduce up-front costs.

If PV systems are financed by third parties through a lease or PPA, the first cost of the building might not be impacted, and building occupants will experience immediate savings on energy bills.

Greater cost savings can be realized by installing PV systems on new buildings at the first construction outset due to ease of permitting, more efficient inspections, the ability to integrate solar installations with the regular building schedule and the efficiencies of repetitive procedures.

CE263-19 Part II

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

RB103.5 Community solar facility. Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community*

solar facility shall provide energy ~~savings~~ benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy ~~savings~~ benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the ~~reductions in energy consumption~~ generation of energy that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy ~~savings~~ benefits to the dedicated *building* for a period not less than twenty years. The energy ~~savings~~ benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

Committee Reason: The proposal is needed, in the future, it does need work and "future proofing". The modification offers a clarification and there is consensus it was needed (Vote: 7-4).

Assembly Action:

None

CE263-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC@: (New), SECTION RB103 (New), RB103.1 (New), RB103.2 (New), SECTION RB104 (New), RB104.1 (New)

Proponents:

Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA)
(JoeCainPE@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system and allocates bill credits to customers, and is qualified as a community energy facility, ~~and allocates bill credits to customers,~~ under state and local utility statutes and rules.

STEEP SLOPE. A roof slope ~~greater than~~ two units vertical in 12 units horizontal (17-percent slope) or greater.

SECTION RB103 SOLAR PHOTOVOLTAIC SYSTEM

RB103.1 Renewable energy systems. Newly constructed residential buildings shall have an on-site solar photovoltaic (PV) system installed. Photovoltaic systems shall comply with Sections RB103.2 through RB103.6. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1. Where the code official determines there are practical challenges that cause satisfaction of the requirements to be infeasible. Practical challenges include, but are not limited to, building site location, limited rooftop availability, or shading from nearby structures, topography, or vegetation.
2. Where the code official determines the purpose and intent of this provision is satisfied through the use of alternative on-site renewable energy systems ~~such as wind energy systems.~~
3. If the code official ~~determines~~ approves an on-site or off-site community solar facility ~~is~~ dedicated to the building with a legally binding and executed agreement, and is in conformance with Section RB103.5.

RB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section RB103.2.1 or performance PV sizing in Section RB103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section RB103.2.2. Where the simulated performance alternative of Section R405 is used for compliance, the PV capacity provided in accordance with this section shall not be included in the analysis or shall be the same in the standard reference design and the proposed design. Where the energy rating index of Section R406 is used for compliance, the PV capacity provided in accordance with this section shall not be used to show compliance with the maximum energy rating index of Section R406.4 but shall be permitted to be included in an energy rating index used for other purposes.

SECTION RB104 LEASES AND PURCHASE AGREEMENTS

~~**RB104.1 Leases and power purchase agreements.** On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.~~

Commenter's Reason: For this Public Comment:
The definition of Community Solar is revised as an editorial change only.

The definition of Steep Slope is revised to be consistent with Proposal G9-19, which was Approved as Submitted by the Structural Committee, by unanimous vote.

G9-19: THIS CODE CHANGE WAS HEARD BY THE IBC-STRUCTURAL COMMITTEE. Committee Action: As Submitted Committee Reason: Editorial: The proposal corrects the definition to be consistent with the requirements in Chapter 15. (Vote: 14-0) Assembly Motion: None

RB103.1 is revised in response to stakeholder input:

- to clarify that Items 1 through 3 are conditions, rather than exceptions
- editorial changes to Conditions 2 and 3

RB103.2 is revised in response to stakeholder input:

- to clarify the language regarding Sections R405 and R406, to preclude the possibility of double-counting renewable energy systems required to be installed when this appendix chapter is adopted.

RB104 is removed in response to committee discussion, with a committee member pointing out that ownership of a PV system is not relevant to IECC requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. This proposal will increase the first cost of construction for PV systems that are a cash purchase, but not for systems that are under lease agreements or power purchase agreements (PPA's). The installed cost of new PV systems retrofitted on existing homes is approximately \$2.50 per Watt. Greater cost savings can be realized owing to installations on new homes and the efficiencies of repetitive procedures.

Public Comment# 2079

Public Comment 2:

IECC®: RB103.2 (New)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

RB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section RB103.2.1 or performance PV sizing in Section RB103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section RB103.2.2. Where the simulated performance alternative of Section R405 is used for compliance, the PV system capacity provided in accordance with this section shall not be included in the analysis or shall be the same in the standard reference design and the proposed design. Where the energy rating index of Section R406 is used for compliance, the PV system capacity provided in accordance with this section shall not be used to show compliance with the maximum energy rating index of Section R406.4 but shall be permitted to be included in an energy rating index for other purposes.

Commenter's Reason: This public comment is provided in the event that CE263-19-Part 2 is not disapproved at the public hearing. There is at least one significant concern that is addressed by this public comment. It is related to clarifying that mandated PV capacity should not be used as a basis for making trade-offs that decrease the building performance and thus negate the benefits of adding the mandated PV to a building (the same should also apply to voluntary use of renewable energy generation for the same reason). Renewable energy is not free and is not an unlimited resource. The ability to use it to minimize non-renewable energy use requires that energy conservation not be sacrificed. This public comment is aimed specifically at that concern. At a minimum, CE263-19-Part 2 should be modified to address this concern or be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

It is not clear that the public comment would add any additional cost to the original proposal. It will, however, prevent mandated PV (if adopted) from being subsidized by weakening the building's energy conservation measures through trade-offs in the ERI and performance simulation paths. Consequently, this PC will tend to decrease cost of building operation and maximize the benefits of PV.

Public Comment 3:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it has the potential to create substantial problems for jurisdictions that choose to adopt the new Appendix. This proposal, if adopted by a jurisdiction, appears to attempt to establish a mandatory requirement to install a certain amount of solar generation in each building (or acquire an amount of "community solar generation"), regardless of the energy efficiency measures installed or the cost-effectiveness. We agree with the Commercial Committee that this proposal should be disapproved. Even though the IECC-Residential Committee approved Parts 2 and 3, it acknowledged in its reason that "it does need work." The proposal raises a significant number of questions and will lead to confusion. CE263 prioritizes one electric generation technology (Solar PV) over all others, it introduces new concepts that are not adequately defined, and it creates uncertainty in several areas of the code. This proposal would bring about a major change in the scope and operation of the IECC, and as such, it should be more carefully developed and vetted before being added to the IECC.

We fully support on-site renewable generation as an important technology that should be incorporated in buildings, where appropriate. However, we believe that in a building energy conservation code like the IECC, solar and other renewable energy generation technologies should be designed to meet remaining energy requirements, only after installing all reasonable energy efficiency measures. In other words, renewable energy should not replace reasonable energy efficiency measures -- energy efficiency should be optimized first, before turning to renewable electric generation. Utilizing solar energy to offset inefficient building energy use is wasteful and such energy could be better used for other purposes. Moreover, solar is not the only renewable technology in the arsenal. Therefore, it is important to carefully design any renewable requirements in the code. This code proposal does not meet this standard:

- **CE263 fails to improve energy efficiency.** As noted above, CE263 does not seek to improve efficiency at all, but simply requires a certain amount of solar. We think this is effectively "putting the cart before the horse." In our view, an appendix to add a substantial renewable energy requirement to a building energy efficiency program should first optimize and maximize building energy efficiency.
- **RE223 is a far preferable approach to CE263.** A good example of an appendix that first substantially increases building energy efficiency and then adds a complementary renewable energy requirement is RE223, which we support instead of CE263. (RE223 requires additional energy efficiency in the form of an ERI in the 40s, includes a strong envelope backstop, and then adds sufficient renewable generation to approach net zero.)
- **CE263 fails to provide sufficient technical justification to support the amount of solar required.** The proposal does not demonstrate why the minimum amount of solar required under the proposal is reasonable. CE263 Parts 2 and 3 include two methods for determining the size of the PV system required. Under the prescriptive PV sizing method (RB103.2.1), the size is calculated based on the conditioned floor area. Under the performance PV sizing method (RB103.2.2), the system is sized to "meet at least 75 percent of the building's total electrical energy use ..." The basis for and feasibility of both of these approaches is unclear. Nor have the two approaches been shown to produce comparable or reasonable results.
- **CE263 prioritizes one technology over all others and fails to provide clarity as to when the requirements do not apply due to "infeasibility."** CE263 sets a clear preference for promoting solar photovoltaics instead of energy efficiency or any other renewable energy. Rather than requiring a more inclusive list of renewable energy resources for new buildings, CE263 requires an "on-site solar photovoltaic system," with three exceptions. One exception is for on- or off-site community solar, and another exception allows the code official to ignore the requirements where "infeasible." The other exception, which would allow the use of "alternative on-site renewable energy systems such as wind energy systems," will only apply if approved by the code official. The preference for one technology over any others in this new section is problematic. To the extent that renewable energy is to be required for all new buildings, all renewable resources should be on a level playing field, to the extent possible. Moreover, the exception for "infeasibility" to be determined by the code official would likely create enforcement nightmares.
- **CE263 treats leased photovoltaic systems in the same manner as systems that are part of the real property.** Section RB104.1 would allow a leased system (or a power purchase agreement) to meet the requirement for on-site power, even though the tenant may move out or the owner may sell the building, taking the lease with them. Leased systems (often treated as personal property) are simply not equivalent to

permanent renewable energy systems that are part of the real property and should not be treated as such in the code. This is a potentially huge loophole that could allow builders, owners and lessors to step around this requirement. Moreover, these provisions pose issues for code officials, who will be required to review and interpret these agreements.

- **The provisions in CE263 for community solar are problematic and confusing.** First, the definition of community solar is far too broad. "A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules." This definition could be read to include utility "green tariff" programs, or renewable systems that may be located across the country. Whether that was the intent of the definition or not should be made clear. Second, section RB103.5 confuses energy savings with energy generation. We note that even though the Committee attempted to fix these problems, the modifications only confuse matters more. The modified RB103.5 requires a community solar facility to "provide energy benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system." The production of renewable energy does not actually save any energy, and it is not clear what "energy benefits" are, since that term is not defined anywhere in the IECC.

An on-site or community-based photovoltaic system produces energy during daylight hours – some of which will be used to offset electricity purchases from the utility, and some of which will presumably be sold back to the utility. Should electricity sold back to the utility count as "energy benefits," even though the electricity was not being used by the building during these times? We are concerned that treating all energy produced as "energy saved" or "energy benefits" does not accurately portray the true impact of photovoltaic systems. The proposal also does not explain how on-site renewable energy will be valued in comparison with energy use. What method should be used to accurately estimate solar energy production for the specific home? These are all important issues that could have a major impact on builders and homeowners.

- **CE263 creates uncertainty regarding the treatment of renewables in base code compliance paths.** Section R405 (Simulated Performance Alternative) has never allowed on-site generation as a trade-off against energy efficiency, but we are concerned that someone may try to construe the addition of this appendix as allowing such trade-offs. We note that the IECC-Commercial Committee recommended disapproval of CE263 Part 1 for several reasons, including the risk that it "appears to trade off renewables for efficiency in C407 [performance path]". Another concern is how renewable energy under the new appendix will be treated under the ERI. There does not appear to be a provision to prevent double-counting this energy and also using it under the ERI to improve the ERI score.

CE263 would introduce a host of new problems for jurisdictions that adopt the new appendix and should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. No change to code.

Public Comment# 1514

Public Comment 4:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:

-It is picking one technology as the primary "winner". There are other renewable energy technologies on the market.

-Exception 3 only allows the use of community solar facilities, and not any other type of community renewable energy production systems.

-It increases the burden on the code official to determine if there are "practical challenges" to install PV, or whether an alternative on-site renewable energy system satisfies the purpose and intent, or to review contracts with community solar facilities. It provides no guidance as to what is meant by "limited rooftop availability" (5%? 90%) or shading (X% of the roof is shaded for X% of daylight hours?).

-Under the prescriptive sizing method, it does not account for the space needed on the roof to meet 1.0 Watts/square foot and to meet the fire code clearance requirements.

-Under the performance sizing method, which is required for larger houses ($\geq 4,500$ square feet), it encourages the installation of fossil fuel equipment, as the requirement is to size the panel to meet 75% of the building's annual electric usage. The fewer electric end-uses, the smaller the panel has to be.

-It encourages poor design. Under RB 103.3, systems that face due East (90 degrees clockwise from true north) or Northwest (300 degrees from true north) are allowed to comply. As shown in the EIA article from 2014, <https://www.eia.gov/todayinenergy/detail.php?id=18871>, fixed panels facing due south have the highest annual output, while panels facing east or west have much lower output (at the same tilt angle). In addition, tilt

angle also can affect output, as shown at <https://www.civicsolar.com/article/solar-array-tilt-angle-and-energy-output>. Proper tilt is close to the latitude of the home, but this proposal has no tilt angle requirements, so panels can be at sub-optimal angles and still qualify.

-It requires a 20 year contract with a community solar facility, which may be too long for many home owners, who would be more comfortable with shorter-term commitments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will mean that there is no change to the code.

Public Comment# 1355

CE263-19 Part III

IRC: Appendix U (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Residential Code

Add new text as follows:

Appendix U **SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED**

SECTION AU101 **SCOPE**

AU101.1 General. These provisions shall be applicable for newly constructed *residential buildings* where solar photovoltaic (PV) systems are required.

SECTION AU102 **DEFINITIONS**

AU102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

Add new definition as follows:

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers, under state and local utility statutes and rules.

STEEP SLOPE. A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

Add new text as follows:

SECTION AU103 **SOLAR PHOTOVOLTAIC SYSTEM**

RB103.1 Renewable energy systems. Newly constructed residential buildings shall have an on-site solar photovoltaic (PV) system installed. Photovoltaic systems shall comply with Sections AU103.2 through AU103.6. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1. Where the code official determines there are practical challenges that cause satisfaction of the requirements to be infeasible. Practical challenges include, but are not limited to, building site location, limited rooftop availability, or shading from nearby structures, topography, or vegetation.
2. Where the code official determines the purpose and intent of this provision is satisfied through the use of alternative on-site renewable energy systems such as wind energy systems.
3. If the code official determines an on-site or off-site community solar facility is dedicated to the building with a legally binding and executed agreement, and is in conformance with Section AU103.5.

AU103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section AU103.2.1 or performance PV sizing in Section AU103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section AU103.2.2.

AU103.2.1 Prescriptive PV sizing method. For the prescriptive PV sizing method, the PV system installed nameplate capacity (kW_{DC}) shall be not less than 1.0 times the *conditioned floor area* (1.0 Watts per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}).

AU103.2.2 Performance PV sizing method. For the performance PV sizing method, the PV system shall be sized to meet at least 75 percent of the building's total electrical energy use on an annual basis, including both conditioned and unconditioned space. The minimum PV system size requirement (kW_{DC}) shall be calculated using modeling software or other methods approved by the code official.

AU103.3 Photovoltaic system orientation. Fixed-orientation photovoltaic systems located on *steep sloped* roofs shall be oriented with azimuth of each array between 90 degrees and 300 degrees measured clockwise from true north.

Exception: Photovoltaic systems with one or more arrays oriented outside the prescribed azimuth range when the PV system is modeled using performance PV sizing method in Section AU103.2.2.

AU103.4 Shading. All PV systems shall be designed to meet minimal shading criterion in Section AU103.4.1 or the detailed geometries of PV arrays and obstructions shall be considered in the performance PV sizing method in conformance with Section AU103.4.2.

AU103.4.1 Minimal shading criterion. To comply with minimal shading criterion, a PV array shall be no closer to any shading obstruction than twice the height of the obstruction above the PV array. All obstructions that project above the point on the PV array that is closest to the obstruction shall meet this criterion for the array to be considered minimally shaded.

Exception: Any obstruction located north of all points on the array need not be considered as a shading obstruction..

AU103.4.2 Solar access verification. Where any PV array does not meet the minimal shading criterion of Section AU103.4.1, detailed geometries of the PV array and shading profiles from obstructions shall be considered in the performance PV sizing method. Shading profiles shall be measured with a solar assessment tool or determined from aerial satellite images or other automated resources approved by the code official.

AU103.5 Community solar facility. Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community solar facility* shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy savings benefits to the dedicated *building* for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

SECTION AU104 LEASES AND PURCHASE AGREEMENTS

AU104.1 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

CE263-19 Part III

Public Hearing Results

Committee Action:

As Modified

Committee Modification:

RB103.5 Community solar facility. Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community solar facility* shall provide energy ~~savings~~ benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy ~~savings~~ benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the ~~reductions in energy consumption~~ generation of energy that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy ~~savings~~ benefits to the dedicated *building* for a period not less than twenty years. The energy ~~savings~~ benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

Committee Reason: The proposal is needed, in the future, it does need work and "future proofing". The modification offers a clarification and there is consensus it was needed (Vote: 7-4).

Assembly Action:

None

CE263-19 Part III

Individual Consideration Agenda

Public Comment 1:

IRC@: AU103.2 (New)

Proponents:

Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

AU103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section AU103.2.1 or performance PV sizing in Section AU103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section AU103.2.2. Where the simulated performance alternative of Section N1105 is used for compliance, the PV system capacity provided in accordance with this section shall not be included in the analysis or shall be the same in the standard reference design and the proposed design. Where the energy rating index of Section N1106 is used for compliance, the PV system capacity provided in accordance with this section shall not be used to show compliance with the maximum energy rating index of Section N1106.4 but shall be permitted to be included in an energy rating index for other purposes.

Commenter's Reason: This public comment is provided in the event that CE263-19-Part 3 is not disapproved at the public hearing. There is at least one significant concern that is addressed by this public comment. It is related to clarifying that mandated PV capacity should not be used as a basis for making trade-offs that decrease the building performance and thus negate the benefits of adding the mandated PV to a building (the same should also apply to voluntary use of renewable energy generation for the same reason). Renewable energy is not free and is not an unlimited resource. The ability to use it to minimize non-renewable energy use requires that energy conservation not be sacrificed. This public comment is aimed specifically at that concern. At a minimum, CE263-19-Part 3 should be modified to address this concern or be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction. It is not clear that the public comment would add any additional cost to the original proposal's cost increase. It will, however, prevent mandated PV (if adopted) from being subsidized by weakening the building's energy conservation measures through trade-offs in the ERI and performance simulation paths. Consequently, this PC will tend to decrease cost of building operation and maximize the benefits of PV.

Public Comment# 1768

Public Comment 2:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing IECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it has the potential to create substantial problems for jurisdictions that choose to adopt the new Appendix. This proposal, if adopted by a jurisdiction, appears to attempt to establish a mandatory requirement to install a certain amount of solar generation in each building (or acquire an amount of "community solar generation"), regardless of the energy efficiency measures installed or the cost-effectiveness. We agree with the Commercial Committee that this proposal should be disapproved. Even though the IECC-Residential Committee approved Parts 2 and 3, it acknowledged in its reason that "it does need work." The proposal raises a significant number of questions and will lead to confusion. CE263 prioritizes one electric generation technology (Solar PV) over all others, it introduces new concepts that are not adequately defined, and it creates uncertainty in several areas of the code. This proposal would bring about a major change in the scope and operation of the IECC, and as such, it should be more carefully developed and vetted before being added to the IECC.

We fully support on-site renewable generation as an important technology that should be incorporated in buildings, where appropriate. However, we believe that in a building energy conservation code like the IECC, solar and other renewable energy generation technologies should be designed to meet remaining energy requirements, only after installing all reasonable energy efficiency measures. In other words, renewable energy should not replace reasonable energy efficiency measures -- energy efficiency should be optimized first, before turning to renewable electric generation. Utilizing solar energy to offset inefficient building energy use is wasteful and such energy could be better used for other purposes. Moreover, solar is not the only renewable technology in the arsenal. Therefore, it is important to carefully design any renewable requirements in the code. This code proposal does not meet this standard:

- **CE263 fails to improve energy efficiency.** As noted above, CE263 does not seek to improve efficiency at all, but simply requires a certain amount of solar. We think this is effectively "putting the cart before the horse." In our view, an appendix to add a substantial renewable energy requirement to a building energy efficiency program should first optimize and maximize building energy efficiency.
- **RE223 is a far preferable approach to CE263.** A good example of an appendix that first substantially increases building energy efficiency and then adds a substantial complementary renewable energy requirement is RE223, which we support instead of CE263. (RE223 requires substantial additional energy efficiency in the form of an ERI in the 40s, includes a strong envelope backstop, and then adds sufficient renewable generation to approach net zero.)
- **CE263 fails to provide sufficient technical justification to support the amount of solar required.** The proposal does not demonstrate why the minimum amount of solar required under the proposal is reasonable. CE263 Parts 2 and 3 include two methods for determining the

size of the PV system required. Under the prescriptive PV sizing method (RB103.2.1), the size is calculated based on the conditioned floor area. Under the performance PV sizing method (RB103.2.2), the system is sized to “meet at least 75 percent of the building’s total electrical energy use ...” The basis for and feasibility of both of these approaches is unclear. Nor have the two approaches been shown to produce comparable or reasonable results.

- **CE263 prioritizes one technology over all others and fails to provide clarity as to when the requirements do not apply due to “infeasibility.”** CE263 sets a clear preference for promoting solar photovoltaics instead of energy efficiency or any other renewable energy. Rather than requiring a more inclusive list of renewable energy resources for new buildings, CE263 requires an “on-site solar photovoltaic system,” with three exceptions. One exception is for on- or off-site community solar, and another exception allows the code official to ignore the requirements where “infeasible.” The other exception, which would allow the use of “alternative on-site renewable energy systems such as wind energy systems,” will only apply if approved by the code official. The preference for one technology over any others in this new section is problematic. To the extent that renewable energy is to be required for all new buildings, all renewable resources should be on a level playing field, to the extent possible. Moreover, the exception for “infeasibility” to be determined by the code official would likely create enforcement nightmares.
- **CE263 treats leased photovoltaic systems in the same manner as systems that are part of the real property.** Section RB104.1 would allow a leased system (or a power purchase agreement) to meet the requirement for on-site power, even though the tenant may move out or the owner may sell the building, taking the lease with them. Leased systems (often treated as personal property) are simply not equivalent to permanent renewable energy systems that are part of the real property and should not be treated as such in the code. This is a potentially huge loophole that could allow builders, owners and lessors to step around this requirement. Moreover, these provisions pose issues for code officials, who will be required to review and interpret these agreements.
- **The provisions in CE263 for community solar are problematic and confusing.** First, the definition of community solar is far too broad. “A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules.” This definition could be read to include utility “green tariff” programs, or renewable systems that may be located across the country. Whether that was the intent of the definition or not should be made clear. Second, section RB103.5 confuses energy savings with energy generation. We note that even though the Committee attempted to fix these problems, the modifications only confuse matters more. The modified RB103.5 requires a community solar facility to “provide energy benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system.” The production of renewable energy does not actually save any energy, and it is not clear what “energy benefits” are, since that term is not defined anywhere in the IECC.

An on-site or community-based photovoltaic system produces energy during daylight hours – some of which will be used to offset electricity purchases from the utility, and some of which will presumably be sold back to the utility. Should electricity sold back to the utility count as “energy benefits,” even though the electricity was not being used by the building during these times? We are concerned that treating all energy produced as “energy saved” or “energy benefits” does not accurately portray the true impact of photovoltaic systems. The proposal also does not explain how on-site renewable energy will be valued in comparison with energy use. What method should be used to accurately estimate solar energy production for the specific home? These are all important issues that could have a major impact on builders and homeowners.

- **CE263 creates uncertainty regarding the treatment of renewables in base code compliance paths.** Section R405 (Simulated Performance Alternative) has never allowed on-site generation as a trade-off against energy efficiency, but we are concerned that someone may try to construe the addition of this appendix as allowing such trade-offs. We note that the IECC-Commercial Committee recommended disapproval of CE263 Part 1 for several reasons, including the risk that it “appears to trade off renewables for efficiency in C407 [performance path]”. Another concern is how renewable energy under the new appendix will be treated under the ERI. There does not appear to be a provision to prevent double-counting this energy and also using it under the ERI to improve the ERI score.

CE263 would introduce a host of new problems for jurisdictions that adopt the new appendix and should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1516

Public Comment 3:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:

-It is picking one technology as the primary "winner". There are other renewable energy technologies on the market.

-Exception 3 only allows the use of community solar facilities, and not any other type of community renewable energy production systems.

-It increases the burden on the code official to determine if there are "practical challenges" to install PV, or whether an alternative on-site renewable energy system satisfies the purpose and intent, or to review contracts with community solar facilities. It provides no guidance as to what is meant by "limited rooftop availability" (5%? 90%) or shading (X% of the roof is shaded for X% of daylight hours?).

-Under the prescriptive sizing method, it does not account for the space needed on the roof to meet 1.0 Watts/square foot and to meet the fire code clearance requirements.

-Under the performance sizing method, which is required for larger houses ($\geq 4,500$ square feet), it encourages the installation of fossil fuel equipment, as the requirement is to size the panel to meet 75% of the building's annual electric usage. The fewer electric end-uses, the smaller the panel has to be.

-It encourages poor design. Under RB 103.3, systems that face due East (90 degrees clockwise from true north) or Northwest (300 degrees from true north) are allowed to comply. As shown in the EIA article from 2014, <https://www.eia.gov/todayinenergy/detail.php?id=18871>, fixed panels facing due south have the highest annual output, while panels facing east or west have much lower output (at the same tilt angle). In addition, tilt angle also can affect output, as shown at <https://www.civicsolar.com/article/solar-array-tilt-angle-and-energy-output>. Proper tilt is close to the latitude of the home, but this proposal has no tilt angle requirements, so panels can be at sub-optimal angles and still qualify.

-It requires a 20 year contract with a community solar facility, which may be too long for many home owners, who would be more comfortable with shorter-term commitments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproved will mean that there is no change to the code.

Public Comment# 1356

CE264-19

IECC@: AX 100 (New), AX101 (New), AX102 (New), AX103 (New), AX104 (New), TABLE AX104.1 (New), AX104.1 (New), AX104.2 (New), AX104.2.1 (New), AX104.2.2 (New), AX104.2.3 (New), TABLE AX104.2 (New)

Proposed Change as Submitted

Proponents: David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Add new text as follows:

AX 100 ZERO CODE RENEWABLE ENERGY STANDARD

AX101 PURPOSE The purpose of the Zero Code Renewable Energy Appendix is to supplement the International Energy Conservation Code and require renewable energy systems of adequate capacity to achieve zero-net-carbon.

AX102 SCOPE This appendix applies to new buildings that are addressed by the International Energy Conservation Code.

Exceptions:

- 1.Single-family houses, multifamily structures of three stories or fewer above grade in height, manufactured homes (mobile homes), and manufactured houses (modular).
- 2.Buildings that use neither electricity nor fossil fuel.

Add new definition as follows:

AX103 Definitions The following definitions supplement or modify the definitions in the International Energy Conservation Code.

ADJUSTED OFF-SITE RENEWABLE ENERGY. The amount of energy production from off-site renewable energy systems that may be used to offset building energy.

BUILDING ENERGY. All energy consumed at the building site as measured at the site boundary. Contributions from on-site or off-site renewable energy systems shall not be considered when determining the building energy.

ENERGY UTILIZATION INTENSITY(EUI). The site energy for either the baseline building or the proposed building divided by the gross conditioned floor area plus any semi-heated floor area of the building. For the baseline building, the EUI can be divided between regulated energy use and unregulated energy use.

OFF-SITE RENEWABLE ENERGY SYSTEM. Renewable energy system not located on the building project.

ON-SITE RENEWABLE ENERGY SYSTEM. Renewable energy systems on the building project.

RENEWABLE ENERGY SYSTEM. Photovoltaic, solar thermal, geothermal energy, and wind systems used to generate energy.

ZERO ENERGY PERFORMANCE INDEX(zEPI_{PB,EE}). The ratio of the proposed building EUI without renewables to the baseline building EUI, expressed as a percentage.

SEMI-HEATED SPACE. An enclosed space within a building that is heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h*ft² of floor area but is not a conditioned space.

Add new text as follows:

AX104 Minimum renewable energy On-site renewable energy systems shall be installed or off-site renewable energy shall be procured to offset the building energy.

$$RE_{\text{onsite}} + RE_{\text{offsite}} \geq E_{\text{building}}$$

where

RE_{onsite} = annual site energy production from on-site renewable energy systems (see Section AX104.2)

RE_{offsite} = adjusted annual site energy production from off-site renewable energy systems that may be credited against building energy use (see Section AX104.3)

E_{building} = building energy use without consideration of renewable energy systems.

When Section C401.2 (2) is used for compliance with the International Energy Conservation Code, building energy shall be determined by multiplying the gross conditioned floor area plus the gross semi-heated floor area of the proposed building by an EUI selected from Table AX104.1. Use a weighted average for mixed-use buildings.

When Section C401.2 (1) or C401.2 (3) is used for compliance with the International Energy Conservation Code, building energy shall be determined from energy simulations.

TABLE AX104.1 ENERGY UTILIZATION INTENSITY FOR BUILDING TYPES AND CLIMATES (kBtu/ft²-Y)

Building Area Type	Climate Zone																
	0A/	0B/	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
	1A	1B															
kBtu/ft ² -y																	
Multifamily (R-2)	43	45	41	41	43	42	36	45	43	41	47	46	41	53	48	53	59
Healthcare/hospital (I-2)	119	120	119	113	116	109	106	116	109	106	118	110	105	126	116	131	142
Hotel/motel (R-1)	73	76	73	68	70	67	65	69	66	65	71	68	65	77	72	81	89
Office (B)	31	32	30	29	29	28	25	28	27	25	29	28	25	33	30	32	36
Restaurant (A-2)	389	426	411	408	444	420	395	483	437	457	531	484	484	589	538	644	750
Retail (M)	46	50	45	46	44	44	37	48	44	44	52	50	46	60	52	64	77
School (E)	42	46	42	40	40	39	36	39	40	40	39	43	37	44	40	45	54
Warehouse (S)	9	12	9	11	12	11	10	17	13	14	23	17	15	32	23	32	32
All others	55	58	54	53	53	51	48	54	52	51	57	54	50	63	57	65	73

AX104.1 Calculation of On-Site Renewable Energy The annual energy production from on-site renewable energy systems shall be determined using the PVWatts software or other software approved by the code official.

AX104.2 Off-Site Renewable Energy Off-site energy shall comply with Sections AX104.2.1 and AX104.2.2

AX104.2.1 Qualifying off-site procurement methods. The following are considered qualifying off-site renewable energy procurement methods:

1. Community Renewables: an offsite renewable energy system for which the owner has purchased or leased renewable energy capacity along with other subscribers.
2. Renewable Energy Investment Fund: an entity that installs renewable energy capacity on behalf of the owner.
3. Virtual Power Purchase Agreement: a power purchase agreement for off-site renewable energy where the owner agrees to purchase renewable energy output at a fixed price schedule.
4. Direct Ownership: an offsite renewable energy system owned by the building project owner.
5. Direct Access to Wholesale Market: an agreement between the owner and a renewable energy developer to purchase renewable energy.
6. Green Retail Tariffs: a program by the retail electricity provider to provide 100 percent renewable energy to the owner.
7. Unbundled Renewable Energy Certificates (RECs): certificates purchased by the owner representing the environmental benefits of renewable energy generation that are sold separately from the electric power.

AX104.2.2 Requirements for all procurement methods. The following requirements shall apply to all off-site renewable energy procurement methods.

1. The building owner shall sign a legally binding contract to procure qualifying off-site renewable energy.
2. The procurement contract shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property.
3. RECs and other environmental attributes associated with the procured off-site renewable energy shall be assigned to the building project for the duration of the contract.
4. The renewable energy generating source shall be photovoltaic systems, solar thermal power plants, geothermal power plants, and/or wind turbines.
5. The generation source shall be located where the energy can be delivered to the building site by the same utility or distribution entity; the same ISO or RTO; or within integrated ISOs (electric coordination council).
6. The off-site renewable energy producer shall maintain transparent accounting that clearly assigns production to the building. Records on power sent to or purchased by the building shall be retained by the building owner and made available for inspection by the code official upon request.

AX104.2.3 Adjusted Off-Site Renewable Energy. The process for calculating the adjusted off-site renewable energy is shown in the following equation:

$$RE_{\text{offsite}} = \sum_{i=1}^n PF_i \cdot RE_i = PF_1 \cdot RE_1 + PF_2 \cdot RE_2 + \dots + PF_n \cdot RE_n$$

-

where

RE_{offsite} = Adjusted off-site renewable energy

PF_i = Procurement factor for the i^{th} renewable energy procurement method or class taken from Table AX104.2.

RE_i = Annual energy production for the i^{th} renewable energy procurement method or class

n = The number of renewable energy procurement options or classes considered

TABLE AX104.2 Default Off-Site Renewable Energy Procurement Methods, Classes, and Coefficients

Class	Procurement Factor (PF)	Procurement Options	Additional Requirements (see also XXX4.2.2)
1	0.75	Community Solar	-
		REIFs	Entity must be managed to prevent fraud or misuse of funds.
		Virtual PPA	-
		Self-Owned Off-Site	Provisions shall prevent the generation from being sold separately from the building.
2	0.55	Green Retail Tariffs	The offering shall not include the purchase of unbundled RECs.
		Direct Access	The offering shall not include the purchase of unbundled RECs.
3	0.20	Unbundled RECs	The vintage of the RECs shall align with building energy use.

Reason: The new appendix deals with renewable energy and creates a path to a Zero energy design approach, similar to the zEPI that is already found in the 2015 IgCC. It is designed to build on top of the IECC which already sets the minimum energy efficiency requirement. By putting this information in an appendix, jurisdictions will have the option of adoption of these provisions in order to establish Zero as the energy target they wish to achieve.

Cost Impact: The code change proposal will decrease the cost of construction
The overall cost of construction and operation of buildings constructed using the Zero Annex will be lower than other comparable buildings.

CE264-19

Public Hearing Results

Errata: This proposal includes published errata

Go to <https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf>.

Committee Action:

As Submitted

Committee Reason: A lot of jurisdictions need a tool, and without something like this in the code they do not have it. Provides a really important framework, simple calculation methodology. When you have it available in the IECC it has broad availability for adoption. (Vote: 9-6).

Assembly Action:

None

CE264-19

Individual Consideration Agenda

Public Comment 1:

IECC@: AX104.1 (New)

Proponents:

Jonathan Humble, FAIA, NCARB, LEED BD+C, representing Himself (jhumble@steel.org)

Modify as follows:

2018 International Energy Conservation Code

AX104.1 Calculation of On-Site Renewable Energy The annual energy production from on-site renewable energy systems shall be determined using ~~the PVWatts software or other~~ software approved by the code official.

Commenter's Reason: This public comment proposes to delete language for the following reasons:

Codes establish a mechanism for effective regulation of building construction. When codes are adopted by units of government they provide the legal framework for the regulation of public health, safety and welfare in construction. However, when national model codes cite proprietary resources this represents a closed code document. This is not acceptable in the ICC family of codes.

The specific reference to "PVWatts software" [1] fails to mention the source and edition of the software. This is an important observation, as without a date specific edition the user and enforcer of the code are without guidance as to which edition to use in the context of the regulation. In addition, this also sets up a conflict where multiple parties, such as the code official and the design professional, may argue who has authority over that choice of edition. Either way, placing any second tier proprietary document into the code does not serve the code users and enforcers well.

But this software was developed by an arm of the U.S. Government and it is free to download and use, therefore it is critical we have something, right? This is often referred to as "open source software" however, it: 1) is developed by a single source entity, 2) has no edition date, 3) is not consensus developed, and 4) can be modified at any time by the government agency who oversees and maintains this software as shown on the US-DOE/NREL web page and the associated PVWatts technical report [4]. All of these subjects place this specific software in the category as proprietary. Similar programs that have been proposed for consideration by ICC, but were disapproved because they were proprietary, include: RESCheck [2] and COMCheck[3]. As a result, there is precedence in removing the specific reference to "PVWatts software".

For the benefit of code officials, there are other software simulation products [4] available that perform either the same or similar functions. Additional software sources, beyond the list below, are also shown in the paper identified in bibliography item #4.

1) Hybrid Optimization Model for Electric Renewables (HOMER), by the National Renewable Energy Laboratory, Lakewood, CO

See: <https://www.osti.gov/biblio/269387-homer-hybrid-optimization-model-electric-renewable>

2) PVsyst photovoltaic software, Route du Bois-de-Bay, 107, 1242 Stigny, Switzerland

See: <https://www.pvsyst.com/>

3) System Advisor Model (SAM), by the National Renewable Energy Laboratory, Lakewood, CO

See: <https://sam.nrel.gov>

Bibliography:

[1] Dobos, Aron P., "PVWatts Version 5 Manual", US Department of Energy, National Renewable Energy Laboratory, September 4, 2014, Technical Report NREL/TP-6A20-62641, Contract DE-AC36-08GO28308.

<https://www.nrel.gov/docs/fy14osti/62641.pdf>

[2] US-DOE, "RESCheck Building Energy Code Compliance Software", US Department of Energy, Building Energy Code Program, Washington, DC (Various editions).

<https://www.energycodes.gov/rescheck>

[3] US-DOE, "COMCheck Building Energy Code Compliance Software", US Department of Energy, Building Energy Code Program, Washington, DC (Various editions).

<https://www.energycodes.gov/comcheck>

[4] Umar, N., Bora, B. Banerjee, C., Panwar, B.S., "Comparison of different PV power simulation softwares: case study on performance analysis of 1MW grid-connected PV solar power plant", International Journal of engineering Science Invention (IJESI), ISSN(Online): 2319-6734, ISSN (Print): 2319-6726, Volume 7, Issue 7, Ver II, July 2018, Pages 11-24.

https://www.researchgate.net/publication/326919529_Comparison_of_different_PV_power_simulation_softwares_case_study_on_performance_analysis_of_1_MW_grid-connected_PV_solar_power_plant

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The public comment does not modify the technical content therefore there is no change to the cost of construction.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1711

Public Comment 2:

Proponents:

David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

requests As Submitted

Commenter's Reason: Public Comment in support of AS for CE264-19 (Zero Code Renewable Energy Appendix) to the IECC.

As stated in the Purpose section of the Appendix it is a voluntary supplement to the IECC. It allows an adopting jurisdiction to require renewable the energy needed to achieve a zero-net-carbon design for new construction. The renewable energy would be above and beyond all the elements required within the IECC, because it replaces none of them and changes none of them.

The Appendix will offer communities an above code standard for design that will significantly impact the use of carbon-emitting power demands by new buildings within its scope. (Single-family, multi-family three stories or less, manufactured homes and houses and buildings that use neither electricity nor fossil fuels are exempt from compliance to the Appendix.)

The Appendix depends on the IECC to determine the path of compliance that an owner and its design team may choose: performance or prescriptive. It adds to those options multiple methods for satisfying the renewable energy requirement: on-site renewable energy and off-site renewable energy. When using off-site renewable energy the building owner can either procure the renewable energy from a system they own or purchase the renewable energy and its' associated renewable energy credits (RECs), from a variety of sources.

There were three items in the Appendix that were discussed during the hearings:

- IgCC Discussion about the inclusion of a similar proposal within the IgCC which is based on ASHRAE 189.1. Any such adoption by ASHRAE 189.1 into the IgCC would not become part of the ICC codes until 2024 at the earliest and would delay the use of Zero Code Renewable Energy Appendix approach by the ICC. Also, the 189.1 proposal is not as stringent as what is being proposed for the Appendix. The current 189.1 proposal requires about half as much renewable energy. Furthermore, not all the off-site procurement options in the Appendix are recognized by the current 189.1 proposal. The 189.1 proposal only recognizes community solar, vPPAs and self-owned.
- EUI As demonstrated in the following review of the use and application of the Appendix (see section: How to Enforce and Comply with the ZCREA), the EUI values in Table AX104.1 of the Appendix are used *solely* to establish the renewable energy requirement when the prescriptive path is used to comply with the IECC, based on type and climate zone. The performance of the design is based strictly on the energy efficiency requirements of the IECC. The Appendix encourages more efficient design and on-site renewable energy.
- Cost of Construction Today the cost of designing a building and its systems for heightened service and performance to an owner are often "value engineered" out of the design. Adoption of this Appendix will require renewable energy sources and will encourage additional energy efficiency so the renewable energy requirement can be smaller. Measuring the absolute cost of construction and the operation of a building are integral to good design decisions. The Appendix will supports good design decisions.

Attached is a document that clearly explains the paths of enforcement and compliance available, as well as the methods used in the Appendix to determine the renewable energy requirement.

We urge the membership to support the code change CE264-19 As Submitted (AS).

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. The overall cost of construction and operation of buildings constructed using the Zero Annex will be lower than other comparable buildings.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not

a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment 3:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EEC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: We support renewable generation as an important technology that should be incorporated into buildings. We also support establishing a net zero appendix in the energy code that would include renewable generation for jurisdictions to consider. As a result, we would like to support this proposal but have reluctantly concluded that it needs more work before it can reasonably be implemented and therefore should be disapproved and/or significantly modified. Our biggest concern is that the proposal fails to include any energy efficiency improvement in what purports to be a "net zero" compliance path.

In our view, in a building energy conservation code, energy efficiency should be optimized first, before turning to renewable electric generation. Utilizing renewable energy to offset inefficient building energy use is wasteful, and with a more efficient building the same energy could be better used for other purposes. Renewable energy generation technologies should not replace energy efficiency that can be reasonably achieved. Instead, renewable energy should meet remaining building energy needs to achieve net zero, only after installing all cost-effective energy efficiency measures.

This proposal also faces other challenges – it needs more technical support/justification, it requires building code officials to exercise authority or judgment in areas that are typically outside the scope or training of these officials, and it includes a laundry list of complicated renewable compliance options that will likely be difficult to review and enforce. Although this proposal attempts to cover many of the issues that are raised when a jurisdiction requires renewable energy for new buildings, it unfortunately raises additional issues that necessitate further consideration. If this proposal were adopted, we think that additional improvements would be necessary in future code cycles to address these issues and to make the proposal more useable.

To elaborate further on some of our concerns regarding the provisions of CE264:

- **CE264 fails to improve energy efficiency first.** As we understand the proponent's reason, CE264 does not seek to improve energy efficiency, but instead takes the amount of efficiency already required by the code as a given and then requires sufficient solar or other renewable energy to get to a "zero-net-carbon" building. In our view, a net zero energy code appendix should first optimize and maximize building energy efficiency. Simply papering over a less efficient building with excess renewable generation is a big missed opportunity.

Optimizing energy efficiency first is particularly important when the appendix is entitled "Zero Code Renewable Energy Standard" and the purpose is to achieve "zero-net-carbon." If the new appendix is going to call the building "net zero," then the appendix should require considerably more efficiency than the base code. Moreover, we are concerned that interested parties may incorrectly interpret this appendix as setting an optimal amount of energy efficiency, and possibly locking in place the current commercial efficiency requirements.

- **CE264 lacks sufficient supporting technical analysis for such a far-reaching proposal.** It is important to keep in mind that if Appendix AX is adopted by a jurisdiction, it becomes part of the mandatory commercial energy code. It is thus important that the requirements in the new appendix be vetted to at least the same level as any other code change proposal. Unfortunately, no analysis is provided in the proposal that shows that the EUIs in Table AX104.1 are set at appropriate levels for each occupancy type. Nor is there any justification for how the default off-site renewable energy procurement factors in Table AX104.2 were determined. Without sufficient supporting analysis, it will be difficult for jurisdictions to adopt this appendix.
- **CE264 requires code officials to make legal and accounting determinations.** While the IECC has historically dealt primarily with the use and conservation of energy at the building site, CE264 would require verification of several issues beyond the building site. For example, Section AX104.2.2 requires a building owner to "sign a legally binding contract," for qualifying off-site renewable energy, and that contract "shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property." Similarly, Section AX104.2.2(6) requires off-site renewable energy producers to maintain "transparent accounting that clearly assigns production to the building," and must make records available to the building code official upon request. Leaving aside the issue of code officials also being proficient in accounting, this language appears to establish ongoing review and enforcement authority, well beyond the issuance of a certificate of occupancy. It is not clear how this requirement could be enforced once a building is occupied.

- **CE264 is unclear about whether and how performance path compliance in the base code would be affected.** Section AX104 requires renewable energy systems to “offset the building energy.” And where the performance path is selected, “building energy shall be determined from energy simulations.” The commercial performance path in Section C407 currently allows on-site renewable energy to be counted as a reduction in energy cost (limited to 5% of the total energy cost) for code compliance purposes. If new Appendix AX is adopted by a jurisdiction, would code users claim that some or all of the on-site renewable energy could also be used to offset energy-saving features under the simulated performance path or would a building need to demonstrate compliance with both Section C407 and Appendix AX, independently of each other?

While we are very sympathetic to the goals of the proposal, we think it is important to get this issue right. These types of issues in the proposal, if not corrected, may make the proposed appendix very difficult for interested jurisdictions to adopt and enforce and could impede future efforts to promote net zero buildings that incorporate renewable energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1758

Public Comment 4:

Proponents:

Duane Jonlin, Seattle Department of Construction and Inspections, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests Disapprove

Commenter's Reason: Please disapprove the “Zero Code” appendix.

This proposal's most serious flaw is that, if the appendix were actually to be adopted by some jurisdiction, buildings in that jurisdiction would be required to implement the *least* cost-effective means of reducing the energy use and carbon footprint of buildings. In virtually every case, improved efficiency provides a far greater return on investment than renewable energy.

Many aspects of building energy efficiency, particularly the building envelope, will remain unchanged for generations to come, whereas rooftop solar can be easily added in the future, and off-site renewables can be purchased at any time. If we're going to incorporate a very high-performance pathway in the IECC, let's ensure that it provides the biggest bang for the buck possible. As one potential path, the 2030 Challenge target for the years 2020 – 2025, to which hundreds of architectural firms have already committed, is an 80% reduction below the existing average. This approach is outlined in the Architecture 2030 website as follows, noting that adding renewables is the *last* step:

1. Establish an EUI baseline and target using the Zero Tool
2. Apply low/no cost passive design strategies to achieve maximum energy efficiency.
3. Integrate energy efficient technology and systems.
4. Incorporate on-site and/or off-site renewable energy to meet the remaining energy demands.

A further concern is that the proposal contains technical flaws:

- The table EUIs are extremely low for some building types (hospital, office) and extremely high for others (restaurant), leading me to believe that any such proposal needs more careful vetting before actually entering the IECC.
- There is inconsistent code language used in scoping and definitions.
- Code officials are required to track and verify purchasing of off-site renewables, something few building departments are equipped to do

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to

code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1987

Public Comment 5:

Proponents:

Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: I understand there is a need for some guidance for jurisdictions who want to get to zero, but there are some technical issues that this proposal contains.

This proposal contains requirements for semi-heated spaces. which does not currently reside in the IECC.

It contains utilizing RECs, which may be difficult to find enough green RECs for this to work.

The values that were used for Table AX104.1 were not explained as to where they came from.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 2082

Public Comment 6:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: There are many problems with this proposal as submitted and it should be disapproved for the following reasons:

-It contains the terms "zero energy" and "zero code". The term "zero energy" is more suited for a misleading marketing brochure, rather than an IECC Appendix or an ICC code. All buildings use energy, and the use of a term like "zero energy", while appealing, is not accurate and can mislead consumers and businesses.

-It does not define the term "zero net carbon", which is in the purpose section.

-The proposed definition for "renewable energy system" conflicts with the current definition of renewable energy sources found in "on-site renewable energy" as well as the approved definition for "renewable energy resources" shown in CE-31.

-In Table AX104.1, the values for "All others" building area types would include energy-intensive facilities such as data centers, full service grocery stores, laundromats, etc. These values are likely to be far too low for energy-intensive facilities.

-Section AX104.2.1 contains vague and incorrect terms that will lead to enforcement issues. For example, it says "Renewable Energy Investment Fund: an entity that installs renewable energy capacity on behalf of the owner". Does that mean that a private company like Solar City or Sun Run is a "renewable energy investment fund"? What if the system is installed by a government agency on behalf of the building? Or installed by a local utility?

If a building has "direct access to wholesale market", they sign a contract with an Electric Wholesale Generator or Independent Power Producer that

sell into the market. They do not sign a contract with a "renewable energy generator".

-Section AX104.2.2 has language that is vague and not enforceable. For example, in Line 2, how is a code official supposed to determine whether a procurement contract is "structured to survive a partial or full transfer of ownership of the property"? Line 4 with the proposed definitions of renewable energy will conflict with state laws. In Line 6, it says that the off-site renewable energy producer "shall maintain transparent accounting that clearly assigns production to the building". How is a code official supposed to determine if they have "transparent accounting"? Also, what if the off-site producer is located in a different jurisdiction from the building?

-Table AX104.2 also has vague and unenforceable language. For REIFs, the table says "Entity must be managed to prevent fraud or misuse of funds". How is a code official supposed to enforce that, especially if the REIF is a national or global entity? It also says for a self-owned off-site system, "Provisions shall prevent the generation form being sold separately from the building". There are times when the system is producing maximum energy and the building is using a minimal amount (e.g., sunny mild weekend day). Why shouldn't the system be allowed to sell the excess power to the grid, or to another end-user?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. Disapproval will mean that there is no change to the code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1364

CE265-19

IECC@: (New), C406.1, C406.10 (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Add new definition as follows:

ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing electrical, thermal, or mechanical energy in order to supply electrical energy at a future time.

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. On-site energy storage system installed in accordance with Section C406.10

Add new text as follows:

C406.10 On-site energy storage system (ESS). An on-site energy storage system with a storage capacity of at least 50 kWh that is not part of an emergency power system shall be installed. The system shall be capable of interacting with the electric grid or on-site renewable energy system or both.

Reason: According to the US Energy Information Administration (<https://www.eia.gov/analysis/studies/electricity/batterystorage/>), at the end of 2017, there were 708 MW and 867 MWh of large scale energy storage systems in operation in the United States. Several states have enacted policies that require large-scale installations of energy storage systems (over 1,000 MW) to support the growth of renewable electric generation systems on the grid and at buildings.

In states with aggressive renewable portfolio standards, energy storage systems are needed to help balance the grid, especially in times of very high supply of renewable energy and low demand (e.g., "the duck curve").

Several utilities throughout the US are providing incentives to customers for installing energy storage systems, based on a minimum capacity. Typically, the minimum capacity requirement has been on the order of 50 kWh or 50 kW for a certain number of hours of discharge.

The definition is needed for clarity to support the for new language for Energy Storage Systems in Section C406.

This is the same definition that is used in the latest version of the *International Fire Code*.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This is one of several additional efficiency options that a building owner or designer can choose from in Section C406. Based on the data from the EIA report, the range of costs for an installed energy storage system ranges from \$500 to \$2500 per kWh, depending on the battery size, battery chemistry, and safety code requirements. Battery prices are declining, which will reduce these costs significantly over the next several years. In addition, state and utility incentives in parts of the US significantly reduce the initial costs.

CE265-19

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: All other points are relational to building size, this doesn't fit with the structure, it must be modeled to be in this table, this point does not represent .25% building energy cost as other points do (Vote: 8-7).

Assembly Action:

None

CE265-19

Individual Consideration Agenda

Public Comment 1:

IECC@: C406.10 (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.10 On-site energy storage system (ESS). An on-site *energy storage system* with a storage capacity of at least 50 kWh that is not part of an emergency power system shall be installed. The system shall be capable of interacting with the electric grid or *on-site renewable energy* system or both.

Energy efficiency credit: On-site *energy storage systems* shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This modification improves the proposal by:

-Providing information for the credit calculations that were approved in CE 218. Electrical energy storage systems will provide the same service or services in all buildings located in any climate zone, which is the reason for the same credit for all building types and all climate zones.

-Encouraging the use of new technology, while improving building energy efficiency. While larger on-site energy storage systems could provide more benefit to the building and/or the grid, it was decided that keeping the points at a minimum level would ensure that other energy efficiency measures would have to be taken to obtain the necessary number of credits in Section C406.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This public comment simply assigns the credit (for a building's energy efficiency credit determination) when the option to install an on-site energy storage system (ESS) is chosen. Because installation of an on-site energy storage system (ESS) is not required, there is no impact to the cost of construction.

Public Comment# 1365

ADM33-19 Part IV

IGCC®: 107 (New), 107.1 (New), 107.2 (New), 107.3 (New), 107.4 (New), 107.5 (New), 107.6 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Michael O'Brian, representing FCAC (fcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

2018 International Green Construction Code

Add new text as follows:

107 FEES

107.1 Payment of fees A *permit* shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

107.2 Schedule of permit fees Where a *permit* is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

107.3 Permit valuations The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the *building official*, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the *building official*. Final building *permit* valuation shall be set by the *building official*.

107.4 Work commencing before permit issuance Any person who commences any work before obtaining the necessary *permits* shall be subject to a fee established by the *building official* that shall be in addition to the required *permit* fees.

107.5 Related fees The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

107.6 Refunds The *building official* is authorized to establish a refund policy.

Reason: There are two different proposals to address consistency in the Fees section – the end result would be coordination between all codes. The intent is consistency in language for ‘Fees’ within the codes – IBC, IFC, IEBC, IWUIC, IZC, Energy – Commercial and Residential.

- Payment of fees – consistent title, always two sentences
- Schedule of permit fees – IBC currently also includes “structures”, while IFC and IEBC also includes “alterations”. IWUIC and Energy do not include anything. Eliminate the laundry list and make all codes consistent.
- Permit valuation: added valuation to IWUIC and Energy; permits can be for other than just buildings
- Work commencing before permit issuance – remove redundant language
- Refunds – no change
- The IZC currently has a section on fees that is very limited. It was not clear what should be added other than a section on refunds.

The BCAC is working from the philosophy that ICC is a family of codes, so administrative requirements should be consistent across books. Most administrative and enforcement matters are the same for any code. Those matters unique for a specific code remain unchanged. This is one of a series of proposals being submitted relating to technical, editorial and organizational changes proposed for the Administrative chapters (Chapter 1) in all of the I-Codes.

While the Administrative Committee will consider each proposal independently, the proposals in this package are a correlated set of companion code change proposals.”

The following is the template utilized to create this code change proposal. There may be some differences depending on the unique applications of each code – such as “building/fire/code official”.

IBC

SECTION 109FEES

[A] 109.1 Payment of fees. A *permit* shall not be valid until the fees prescribed by law have been paid. Nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

[A] 109.2 Schedule of permit fees. Where a *permit* is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

[A] 109.3 Permit valuations. The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the *building official*, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the *building official*. Final building *permit* valuation shall be set by the *building official*.

[A] 109.4 Work commencing before permit issuance. Any person who commences any work before obtaining the necessary *permits* shall be subject to a fee established by the *building official* that shall be in addition to the required *permit* fees.

[A] 109.5 Related fees. The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

[A] 109.6 Refunds. The *building official* is authorized to establish a refund policy.

This proposal is submitted by the ICC Building Code Action Committee (BCAC), the ICC Fire Code Action Committee (FCAC), the ICC Sustainable and Energy and High Performance Code Action Committee (SEHPCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: <https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac/>.

The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2018 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: <https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/>

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change that provides consistency between I-codes.

ADM33-19 Part IV

Public Hearing Results

Errata: This proposal includes published errata
Added proponent to the code change.

Committee Action:

As Submitted

Committee Reason: This proposal clarifies the code and brings consistency across the codes. (Vote: 4-1)

Assembly Action:

None

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Individual Consideration Agenda

Public Comment CCC01-19:

IGCC®: 107 (New), 107.1 (New), 107.2 (New), 107.3 (New), 107.4 (New), 107.5 (New), 107.6 (New)

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); David Collins, representing SEHPCAC (sehpcac@iccsafe.org) requests As Modified by Public Comment

Modify as follows:

2018 International Green Construction Code

107 FEES

107.1 Payment of fees A *permit* shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.

107.2 Schedule of permit fees Where a *permit* is required, a fee for each *permit* shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

107.3 Permit valuations The applicant for a *permit* shall provide an estimated *permit* value at time of application. *Permit* valuations shall include total value of work, including materials and labor, for which the *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the building official authority having jurisdiction, the valuation is underestimated on the application, the *permit* shall be denied, unless the applicant can show detailed estimates to meet the approval of the building official authority having jurisdiction. Final building *permit* valuation shall be set by the building official authority having jurisdiction.

107.4 Work commencing before permit issuance Any person who commences any work before obtaining the necessary *permits* shall be subject to a fee established by the building official authority having jurisdiction that shall be in addition to the required *permit* fees.

107.5 Related fees The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.

107.6 Refunds The building official authority having jurisdiction is authorized to establish a refund policy.

Commenter's Reason: This proposal was approved by the committee, however, it was noted that to be consistent with the terminology in the IGCC, the reference should be to "authority having jurisdiction" rather than "building official." This will not change the intent of the proposal, to allow for the applicable governing authority to establish fees – either as part of the building permit, or as a separate permit.

The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at <http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx>.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. This is an administrative proposal, with no technical changes.